THE REFINER AND NATURAL GASOLINE MANUFACTURER

In This Issue

Standardization of Equipment will be big feature at A. P. I. Meeting in Fort Worth. Preliminary program announced

Pure Oil Company Accomplishes harmony by co-ordinating distant refining activities. Smith Bluff Plant Built in Units.

Boiler efficiency essential to Refining. Some sidelights on construction and operation by Harry Pennington

Efficiency of fractionating towers and reflex condensers is assured through temperature instruments.

Vol. 3 No. 11 Nov., 1924 $1.00 Per Year

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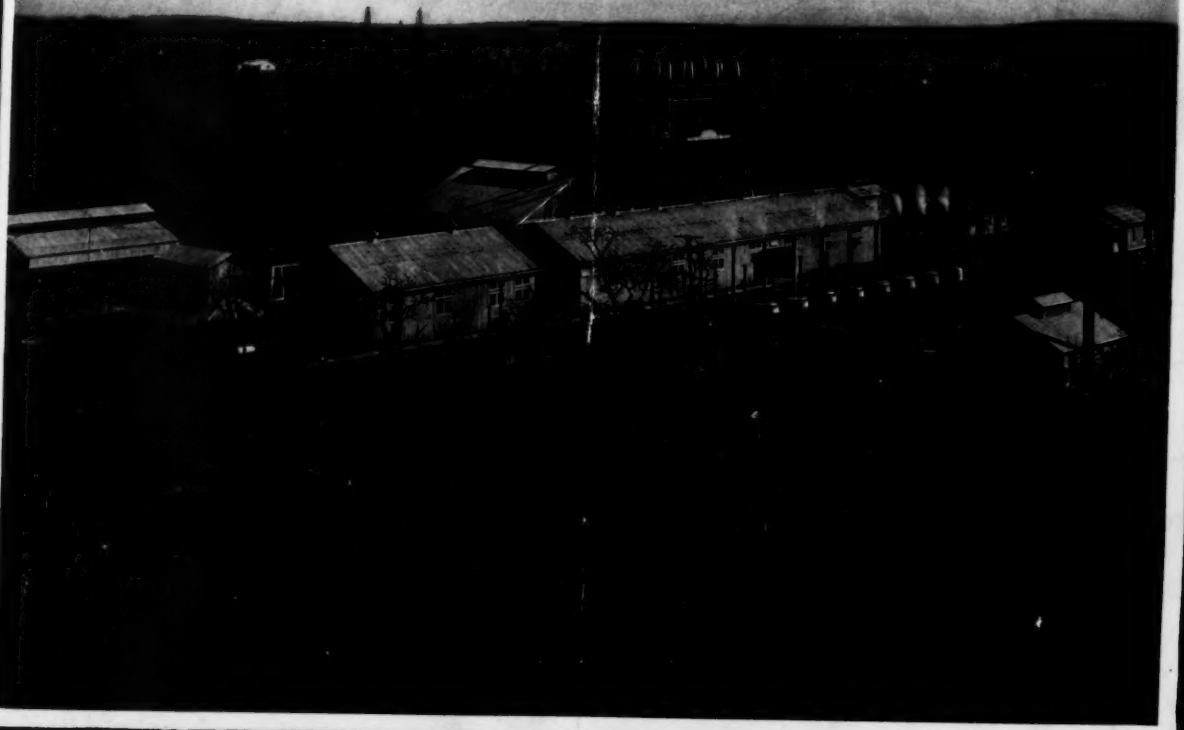
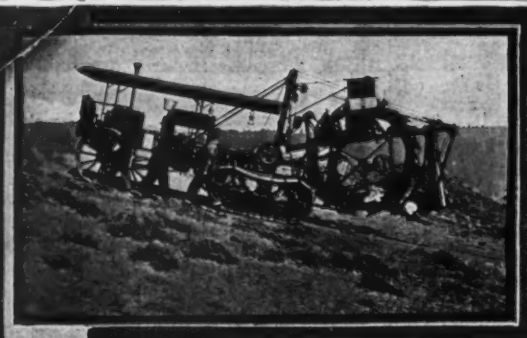


ENGINEERS & CONTRACTORS IN NATURAL GAS AND OIL



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H-3

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Entered as second class matter June 16th, 1923, at the Postoffice at H ouston, Texas, under the Act of March 3, 1879.

(245)

Here's What Happens When Rust Gets A Chance

A tank roof honeycombed with rust holes—evaporation losses many times multiplied—early repairs, if not a gauger drowned, or replacement of the entire roof.

That's why you should paint the underside of your tank roofs.

Back of Degraco Tank Paints stands the integrity of the maker—thirty-five years of close contact with paint problems. A definite knowledge of the service conditions to be met and how to meet them are the basic reasons for their wide and successful use in the oil industry.

You can bank on Degraco Paints to cut down corrosion losses.

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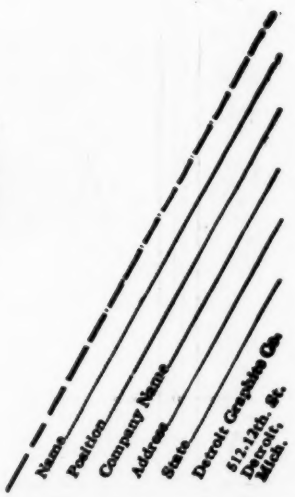

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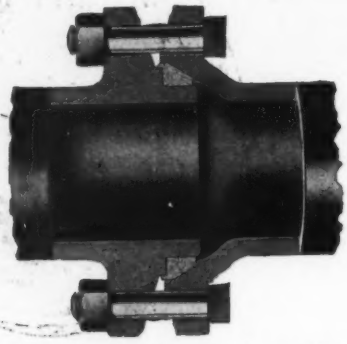

Illustration of section through assembled joint of Simplex Prepared Joint Five-Foot pipe, showing asbestos endless ring gasket in place. This gasket is adapted to use for oil, vapor and acid lines. A rubber gasket is compounded to suit the particular service it is to render—steam, natural gas, artificial gas, water, oil, etc.

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Write Also for Information on Our
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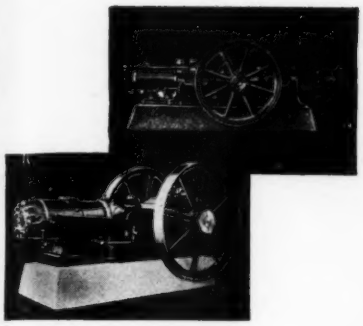
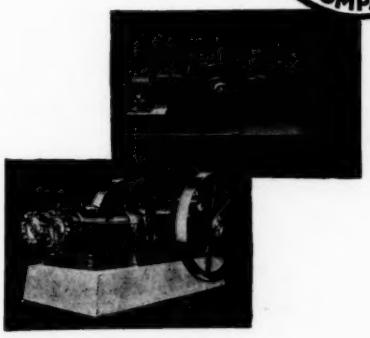


ASK

—the man in the home office which engines in his company's gasoline plants show up the *best in the monthly reports.*

—the district superintendent which engines cause him the *least trouble in the course of a year.*

—the engineer on the job which engines *make his job easiest*



And the answer in an overwhelming majority of cases will come back

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THE BESSEMER GAS ENGINE COMPANY 18 YORK STREET, GROVE CITY, PA.

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The truck that can only carry 3 tons must make three trips to deliver 10 tons and then leave some behind, while the 5 ton truck will take it in two trips

Just so with the Dubbs Cracking Process with its 50% yield each trip, makes it in two runs, while it will take any other cracking process three to deliver the goods and leave some behind and it has to be a selected load for the 3 ton truck but not for the 5

The Dubbs Process will take anything that's hydrocarbon in liquid form and deliver the goods at the lowest cost per gallon of gasoline produced

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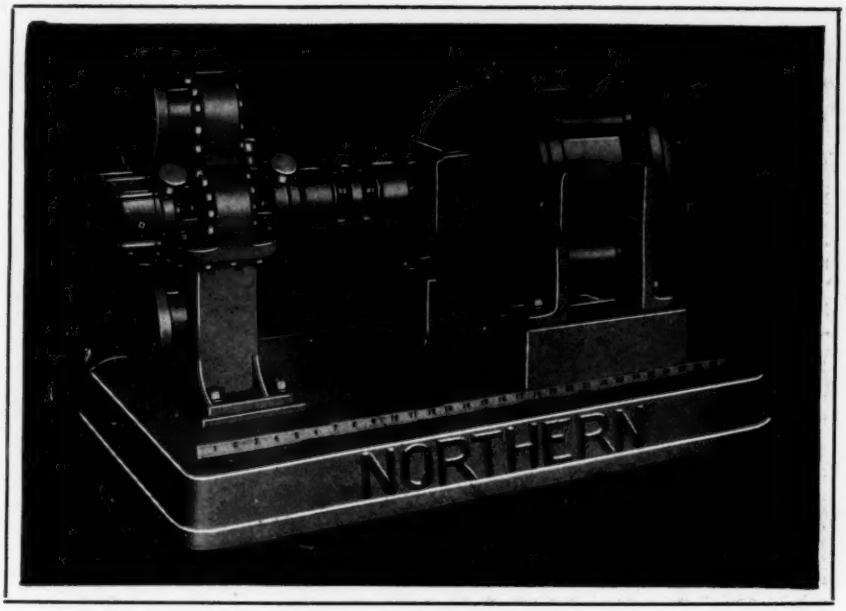


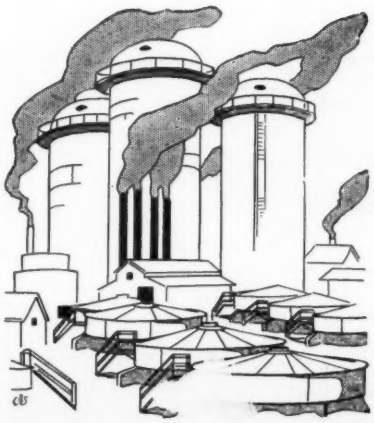
New Style Northern Rotary Pump, size "3E" with 3 H. P., 1150 R.P.M. G.E. Motor. Duty 30 G.P.M. against 113 lbs. Two units placed with the Midwest Refining Co. to handle Evaporator Feed Service.

NORTHERN ROTARY PUMPS
"MORE GALLONS PER HORSE POWER"

Pumps You Can Rely On!

NORTHERN Rotary Pumps are establishing a new degree of pumping reliability in the oil industry. NORTHERN Pumps meet exacting demands where all other pumps have failed.

Design is the secret of the NORTHERN'S efficient performance year after year. It is compact, delivering more gallons per horsepower. Patented lateral ports entirely prevent pulsation. Packing strips in the rotor teeth automatically feed out as they wear, maintaining perfect contact with the cylinder walls.



These and other exclusive advantages in construction have earned the adoption of NORTHERN Pumps by representative oil companies. Won't you investigate NORTHERN Pumps immediately? Write for the full facts.

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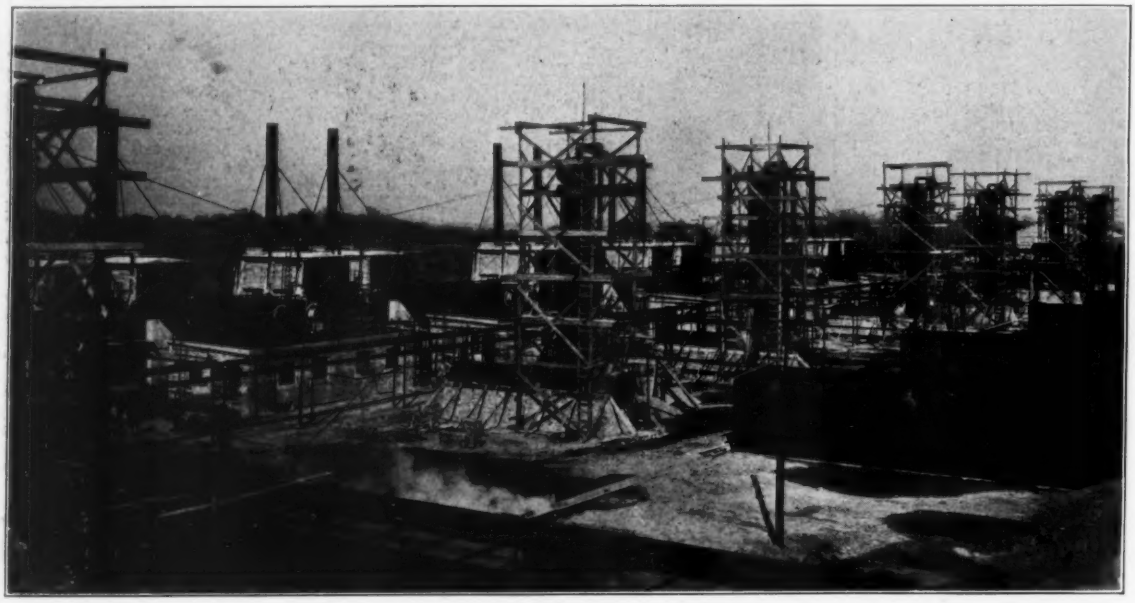

Clean Tubes for Your Cracking Process

After each run, clean tubes. That's the rule laid down by experience. Oil still tubes quickly scale with a carbon deposit that destroys efficiency and burns out tubes.

Lagonda Cleaners for this work have been employed by the makers of the different processes and given their stamp of approval. They give you a thorough cleaning, quickly accomplished.

Let us show you the cleaning equipment best suited to your needs.

The Lagonda Mfg. Co.
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FUEL SAVING SPECIALISTS
NEW YORK, CHICAGO, PHILADELPHIA, BOSTON, PITTSBURG, CLEVELAND CINCINNATI, DETROIT, SYRACUSE.
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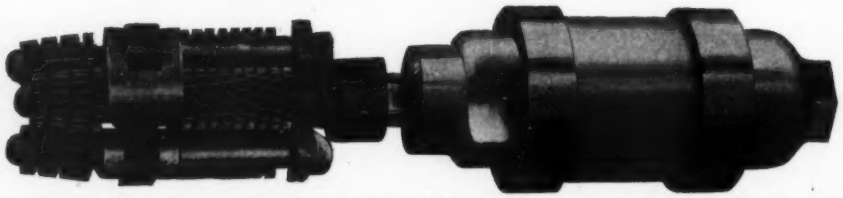
Cleaners for boiler, condenser and other tubes and pipe, tube cutters, cap and header reseaters, cleaner feeding device etc.



Lagonda Air or Steam Driven Cleaner with special long surface cutting head for oil still work.

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Lagonda Cleaners

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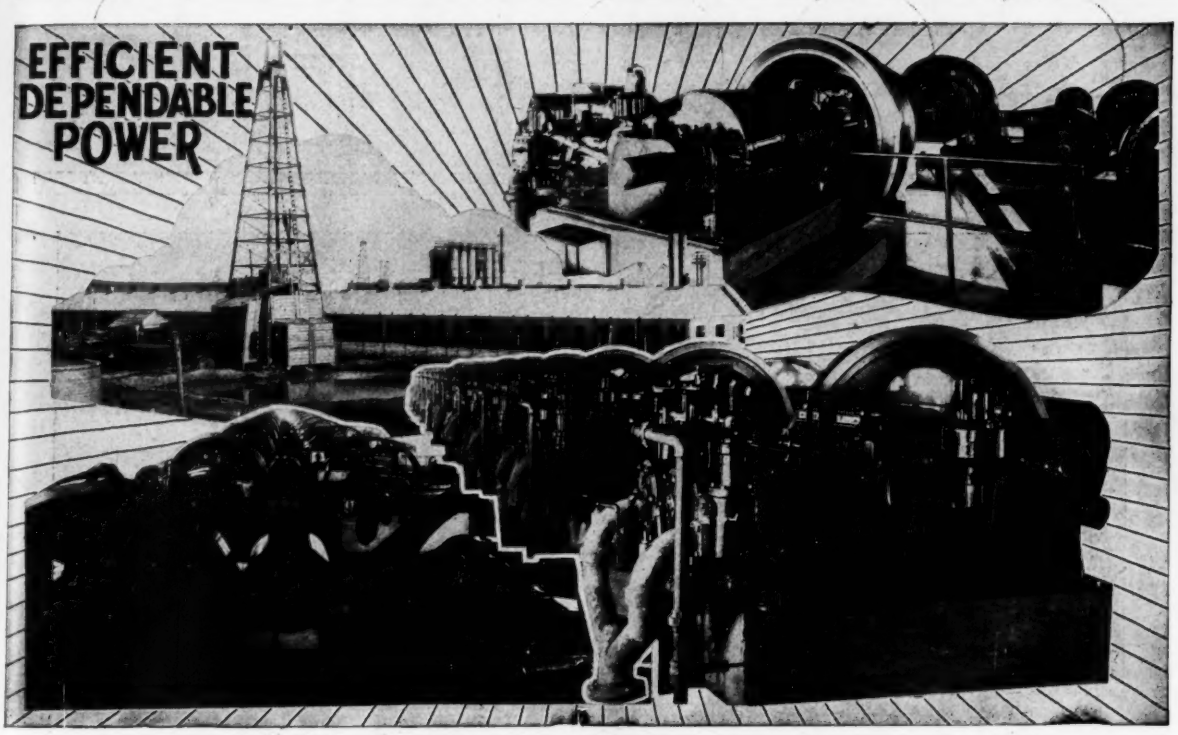

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CLOSE COUPLED-BELT DRIVE-MINIMUM FLOOR SPACE WITH ALL THE FLEXIBILITY OF A STEAM PLANT

All the advantages of a steam plant—without any of its many disadvantages—plus the added and more desirable features of gas engine power, are embraced in this complete "Western" Gas Engine equipped gasoline plant of the Skelly Oil Company at Lyman, Oklahoma.

The fourteen (14) "Western" Engines installed in this plant are used for driving everything from vacuum pumps to generators—using "Western" Type "S" Idlers for close coupled belt drive to compressors and generators—efficiently utilizing every foot of the minimum floor space required.

"Western Engines have set the pace in the oil industry for almost a quarter of a century. If you have power problems tell us about them.

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GAS ENGINES

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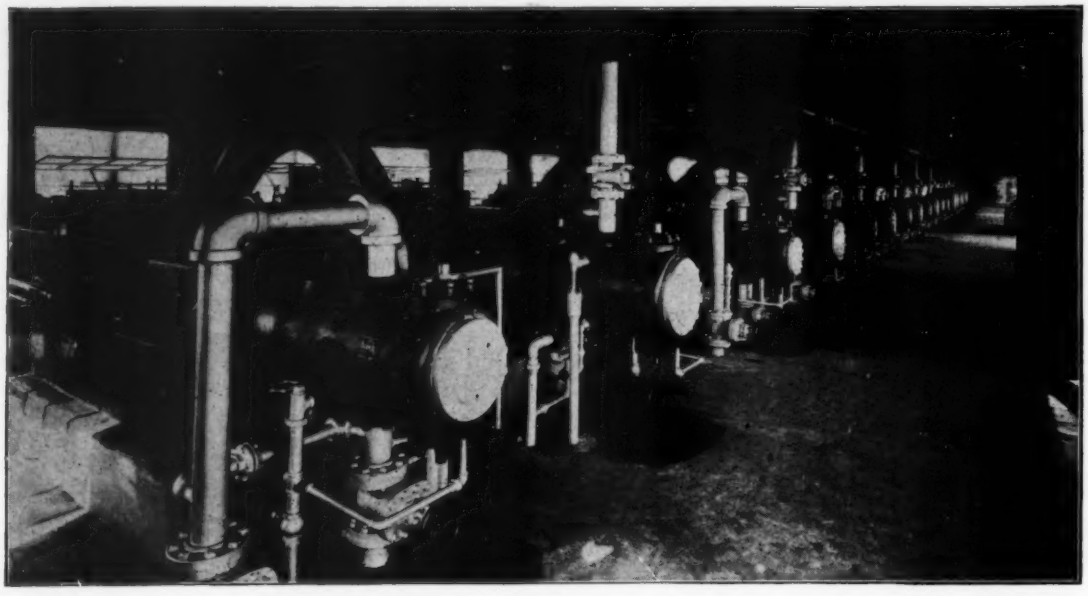

Skelly Oil Uses Cooper Engines for Addition to Lyman, Oklahoma Plant

The photograph shows six Cooper 160 H. P. four cycle gas engines driving two stage Cooper Compressors and eight Cooper 160 H. P. engines direct driving single stage Cooper Compressors in Skelly Oil Company's station at Lyman, Oklahoma. These units have all been put into operation during the year. The older machines in the background are belt driven units.

The well laid out and carefully kept appearance of this plant speaks of the pride which Skelly engineers take in these Cooper units and is a compliment to the whole Skelly organization.

The C&G COOPER CO.
MT. VERNON, OHIO
504 Kennedy Building, Tulsa, Oklahoma
Since 1833 Engineers and Builders

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Published Monthly by GULF PUBLISHING Co.
Houston, Texas

For men engaged in the operating branch of the refining and natural gasoline business.

Vol. 3 November No. 11

R. L. DUDLEY, President and Publisher

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A. P. I. Preliminary Program Announced

Standardization of equipment to draw attention at Fort Worth—Manufacturers may organize

PRELIMINARY announcements concerning the fifth annual meeting of the American Petroleum Institute, to be held in this city from December 9 to 11, inclusive, have been sent out from Institute headquarters. Many well known names appear on the program, and the meeting promises to be a period of constructive effort on behalf of the oil industry. Group meetings dealing with different phases of petroleum will consume the greater part of the meeting, there being only one general session provided for.

After each speech in the group meetings, the meeting will be thrown open for general discussion and consideration of the subject.

Arrangements are being made by chairmen of various Institute committees to hold meetings at Fort Worth on Monday, December 8.

Advice from local hotels as to reservations for the meeting indicates a heavy attendance.

Special trains are being arranged on most every line leading into Fort Worth and a reduction of 25 per cent on railroad fare, on the certificate plan, will apply. Briefly the plan is as follows: Tickets at the regular one-way tariff rates for the going journey may be obtained only on December 5, 6, 7, 8, 9, 10 and 11, except for points in California and other Trans-Continental Passenger Association territory where tickets may be bought from December 3 to 9. At the time the ticket is bought the purchaser should ask for a certificate.

Upon arrival in Fort Worth, these certificates should be presented to the endorsing officer at the registration desk. Special agents will be present from December 9 to 12 to validate certificates.

Reduced rate on the return journey is not guaranteed, but is contingent on an attendance of not less than 250 men and dependent members of their families who hold and present certificates to the endorsing officer.

If the necessary minimum of 250 certificates are presented to the special agent and a certificate is duly validated, it entitles its holder, up to and including December 16, a return ticket via the same route over which the going journey was made, at one-half the regular one-way tariff fare.

Manufacturers of and dealers in oil well supplies and equipment will hold a conference at the Texas Hotel, Monday evening, December 8, to discuss the formation of a national organization.

The preliminary program for the meeting is as given below:

Tuesday, December 9, 1924

Morning

10:30 a. m. Meeting Board of Councillors. (To nominate candidates for election as members of the Board of Directors.)

Afternoon

2:30 p. m. General Session:

The President's Address: Thomas A. O'Donnell.

Subject to be announced: Charles E. Mitchell, President, National City Bank of New York City.

Evening

8:00 p. m. General Session:

Report of Board of Councillors and Election of Directors.

"The People, the Government and the Oil Industry," Amos L. Beaty, The Texas Company.

"Real Friends of the People," Bruce Barton, Barton, Durstine & Osborn.

Wednesday, December 10, 1924

Important Note—The only general session on this day will be in the evening at 8 o'clock. The entire day will be devoted to group sessions, at which various subjects given below will first be treated in a prepared address by a selected speaker. After each speech, the meeting will be thrown open for general discussion and consideration of the subject.

Morning

10:30 a. m. Meeting Board of Directors.

10:00 a. m. Group Meetings.

Group 1—General Topic: Standardization of Oil Field Equipment.

"Standard Specifications for Steel and Iron Pipe for Oil Country Tubular Goods." Committee Report: J. Edgar Pew, National Chairman.

"Dimensional Standards of Cable Drilling Tool Joints." Committee Report: J. T. Kirby, National Chairman.

"Standardization of Belting." Committee Report: William Warr, National Vice-Chairman.

"Standardization of Oil Field Boilers." Committee Report: A. B. Steen, National Chairman.

Group 2—General Topic: Problems in Connection with the Storage and Transportation of Petroleum and Its Products.

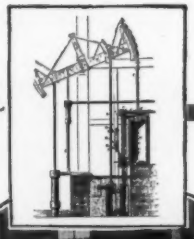
"Reducing the Losses from Natural Gas Gasoline," D. E. Buchanan, President, Association of Natural Gasoline Manufacturers.

"Report of Investigations on Methods of Determining the Vapor Pressure of Gasoline for Transportation Classification," H. L. Shoemaker, Standard Oil Company of New Jersey.

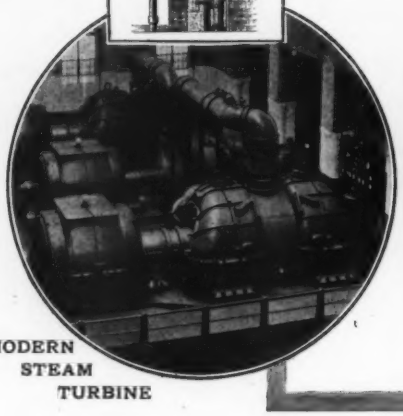
Round Table Discussion of an Abridged Table for Reducing the Vol-

(Continued on page 39)

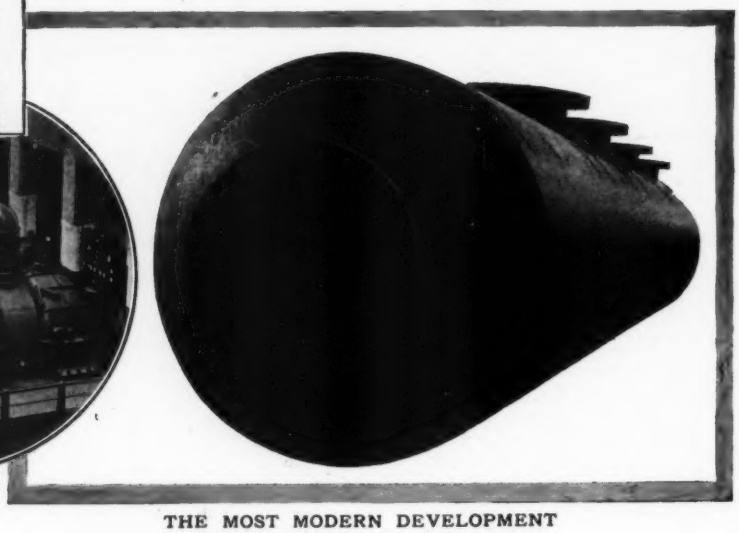
Pressure of Economic Forces



WATT'S ORIGINAL STEAM ENGINE 1774



MODERN STEAM TURBINE



THE MOST MODERN DEVELOPMENT OF STEEL PLATE CONSTRUCTION— A SEAMLESS, BOTTLE-TIGHT HAMMER-WELDED STILL

Pressure of Economic forces demanded the development of the modern steam turbine from the crude machine of James Watt.

The same forces demanded the development of the Blaw Knox Hammer Welding Process for the manufacture of tanks, oil cracking stills, autoclaves, etc.

Seamless—One Piece—Bottle Tight

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PLATE WORK
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Boiler Efficiency Essential to Refining

Water tube types should be built to operate at from 150 to 200 per cent of load

By Harry Pennington
Mechanical Engineer

BECAUSE of the large amounts of fuel used in great central power stations, every phase of steam generation has been considered in detail, at length, critically, over long periods, continuously, with the economy and service.

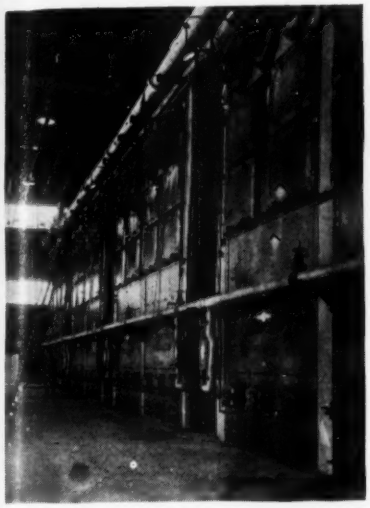


Figure 1.—Water tube boilers of 4,000 horsepower in refinery work.

We now find that the same boiler, set so that the furnace will burn a larger amount of fuel properly, will carry 200 per cent load safely, with no loss in economy and 300 per cent load with but little loss in economy. The writer has tested water tube boilers up to 500 per cent of rating and found that this rating may be maintained over short periods without difficulty.

And, since this has been made possible, it is now good mechanical engineering to design a water tube boiler installation to operate at 150 per cent load up to 200 per cent. The term boiler horsepower is a misnomer anyway; boilers do not develop horsepower, but generate steam from which a prime mover may develop horsepower. But the general term of horsepower is applied to boilers and is defined as the capacity to convert 30 pounds of water into steam at 70 pounds or using the evaporation factor, 34½ pounds of water into steam from and at 212 Fahrenheit.

Then, to develop 500 horsepower the boiler must generate 17,250 pounds of steam from and at, whether 4,500, 5,000 or 6,000 square feet of heating surface is contained in the boiler. And, the practice of assigning an arbitrary number of square feet of heating surface per horsepower is also a thing that does not reflect the performance of boilers.

Where 10 square feet per horsepower is required in one design, another may require only 5 square feet, while still another may require 12. If all boilers performed alike as to steam generating capacity, the steaming rate would have to be the same in all to take the rating of 10 square feet per boiler horsepower, which would be 3.45 pounds of steam per square foot per hour. So that to use anything but actual performance is misleading, and arbitrary ratings have no real basis for comparison of boilers, any more than we can use the basis of avoirdupois when measuring the intellectuality of men, by ascertaining how much they weigh.

Furnaces, Too

For boilers are but the product of intellect, skill in design, of the individual specialist; when the designer is skilled, the product reflects his ability. Not only is the boiler itself subject to every kind of analysis with reference to fuel fired, but the furnace is also subject to analyses with reference to the boiler it is to serve. Then, boilers and furnaces go hand in hand and are therefore components of steam generation.

The greatest improvements have been made in furnace design and methods of firing. A modern water tube boiler setting is very noticeable because of the great height as compared with older settings. This is made necessary by the furnace volume required for high combustion rates and perfect combustion. Figure No. 1 shows four batteries of water tube boilers in use for refining work. There are two boilers per battery and each boiler has 5,000 square feet of heating surface, so that the rating of each is 500 horsepower; but this station has been running continuously at load from 150 to 200 per cent for some years.

We find now that the amount of fuel that may be economically fired is 4 to 5 pounds of oil per cubic foot of furnace volume per hour with natural draft; with forced draft, the amount may be increased to 11 and 12 pounds with fair economy. These rates have always been possible, but the boiler has never required them because the boiler itself could not handle the heat; but the gradual modification of the boiler, to provide rapid circulation and large liberating surface, for high rates of steaming has led to succeedingly

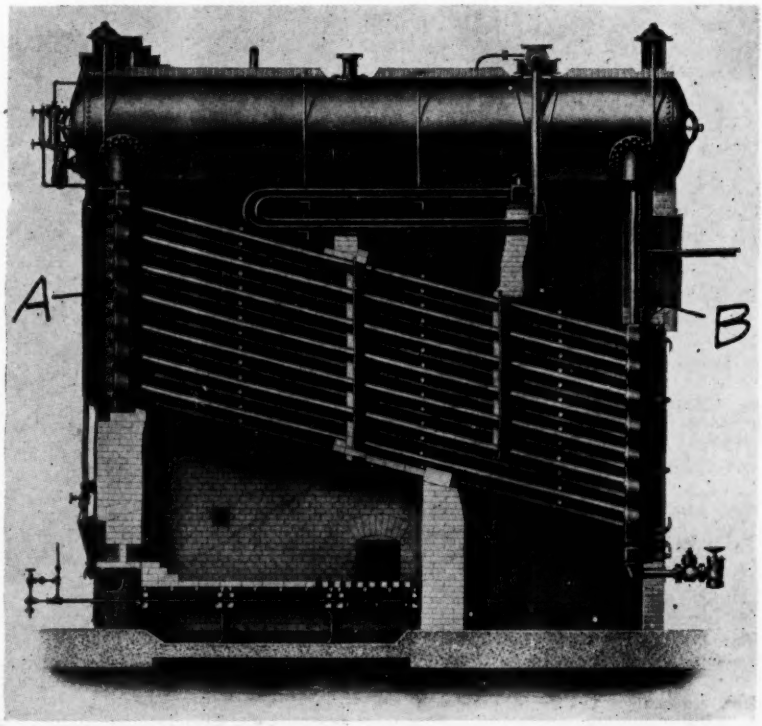


Figure 2.—Babcock & Wilcox boiler with steam atomizing oil burner of same company

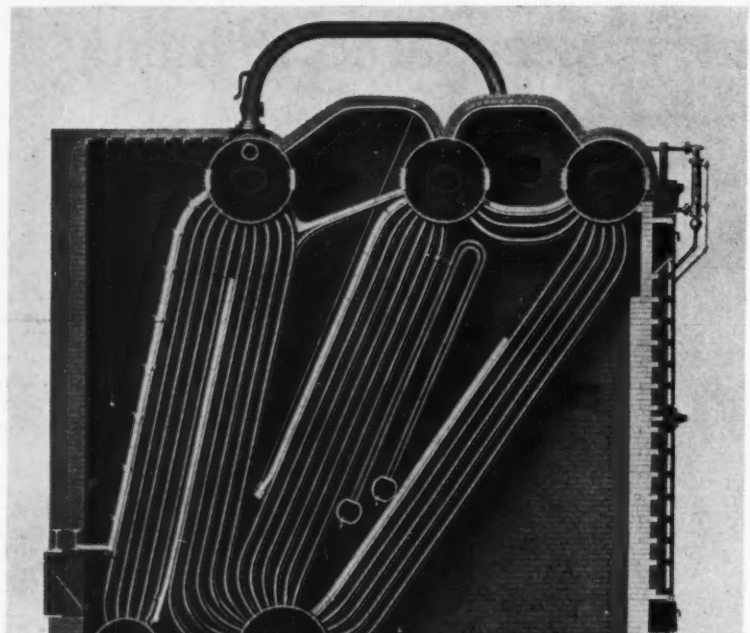


Figure 3.—Sterling boiler.

larger furnaces with correspondingly increasing firing rates.

Economical Steam

The economical rate of steaming is that which produces the maximum of commercially dry steam with the minimum of fuel consumption without undue deterioration of equipment. As to the boiler itself, these depend upon circulation, or the ability of water in the boiler to receive heat and carry it away from the heating surface; and upon the steam liberating capacity of the boiler to turn water into steam. The furnace is quite another problem; here, the fuel must be turned into a maximum of heat, by chemical reaction, combustion, and the measure of furnace efficiency is the quantity of combustible in the fuel that is converted into useful form. If the furnace converts, say 85 per cent of the fuel into usable form, heat, and the boiler fails to use it, then the boiler is deficient. But if the furnace fails, then the boiler cannot make a correction. Therefore, the performance of boilers should be taken as a whole; the combined efficiency of furnace and boiler is the true measure of efficiency. Then, to take a good boiler and set in a poor furnace; or to take a poor boiler and set in a good furnace leads to waste in fuel; and the combination of ill design in both boiler and furnace is very expensive.

Therefore, in boiler testing, the furnace itself must be tested by analyzing the flue gases to ascertain what proportion of fuel has been converted into useful form; what proportion goes out of the stack; what proportion is lost by radiation; and what proportion is otherwise lost, or in other words, a heat balance is necessary for correct gauging of boiler and furnace performance. And, to ascertain the correctness of the heat balance, the boiler must be gauged as to its heat receiving and steaming capacity.

The horizontal return tubular boiler has been changed but little as to the boiler in recent years; the design is not susceptible of the changes that water tube boiler design permit. Therefore, the steaming rates of this type of boiler have not increased in the same proportion as the water tube boiler.

The circulation of water in the tubular boiler is individually its own; there is a movement of water upward, just back of the center, then forward to the front sheet, and down and along the bottom, and also, another movement upward back of the center, then back to the rear sheet, then down and along the bottom forward, thus making two distinct circulating streams within the boiler, as shown by actual tests of glass models. Each pass of circulation carries steam bubbles to the surface, sweeping the fire sheets and tubes free of bubbles that may form and cling. Thus, the circulation in this boiler is not perfectly arranged; the rate of circulation cannot be brought as high as in the fast steaming water tube boiler and to force the tubular boiler means that steam will have too much moisture for satisfactory use.

While the horizontal return tubular boiler will be found much lower in cost per square foot of heating surface, in place, the true comparison of boilers is in performance, and on performance basis, steaming capacity, the water tube boiler found to compare favorably in

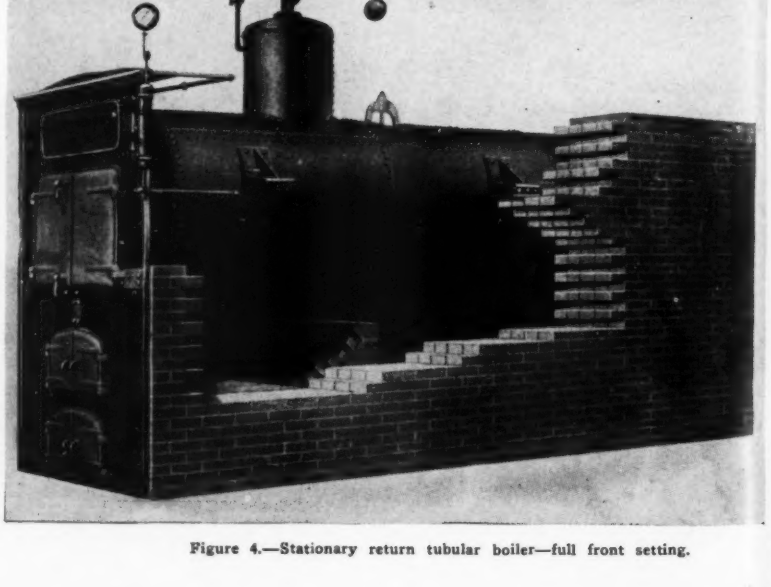


Figure 4.—Stationary return tubular boiler—full front setting.

cost, even, with the horizontal return tubular type.

Horizontal Type Limited

The horizontal return tubular boiler has not the great overload capacity of the water tube boiler, due to inherent circulation qualities; the furnace may be designed large and of such type as will burn large quantities of fuel, but the boiler itself cannot be driven at the continuous high steaming rates per square foot of the water tube boiler.

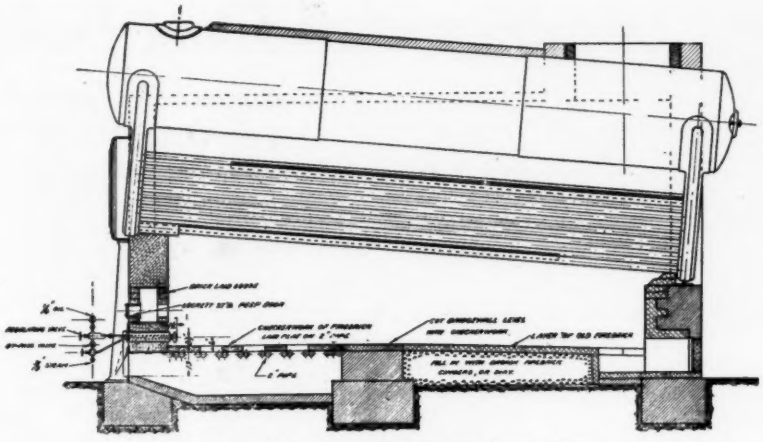
The horizontal return tubular boiler is conventional in design; it is susceptible of little change other than height; therefore the boiler does not lend itself to good furnace design. But the water tube boiler is subject to infinite changes to suit the furnace; the tubes may be spread laterally and the bank made of less height; there may be 15 rows of 20 tubes each, or 20 rows of 15 tubes each, and the correct design of boiler, to secure correct furnace conditions is therefore made with little difficulty.

The horizontal return tubular boiler is not usually given the furnace volume per square foot of heating surface of the water tube boiler; the rate of steaming cannot be as high, so that the same proportionate furnace volume is not necessary but each pound of fuel oil consumed should, of course, have the same furnace volume, for equal conditions, in any kind of boiler setting. Even at this, the horizontal return tubular boiler is not given the proportionately high setting because of the narrow width.

Any boiler can be improved in efficiency of its furnace by giving it adequate draft, volume and correct shape; and any furnace can be improved in efficiency by giving its boiler the proper kind of circulation and the correct rate.

The fuel expense in refining is one of the largest single items; in some refining plants, complete plants, fuel is the largest single item. To generate steam economically is one thing; to use steam economically is quite another; this paper is confined to generation of steam economically. That the whole subject of steam plant—boilers, setting, furnace insulation, draft, dampers, firing methods, control instruments, is worthy may be gathered from the fact that fuel bills in almost all, 99 per cent, of steam boiler installations can be reduced when every detail is analyzed intelligently and then corrections made. Even the very best plants can be operated at greater efficiency by continuous attention, and so closely may this be done that any large central power station can show a record of over-all efficiency at any hour of the day.

Fuel consumption of refineries vary materially; one skimming plant may consume 4 per cent, measured in the terms of crude oil charged to stills; another may consume for all purposes, 2 per cent, and one-half or more of this may be used in the boilers. The difference is not in the oil used, but may be in the design of plant and operation.



Figuer 5.—Heine longitudinal inclined drum boiler.

Units Advantageous

There is one feature that is fortunate in the refinery; the distillation of oil requires that stills must be erected in batteries, consisting of several still units each—five to twelve per battery. To add more capacity means that stills are added as batteries and, to serve the stills, boilers are also added in the same proportion. Thus, the refinery lends itself to unit construction and, whether large or small, one refinery has the opportunity of a larger one for economical design and operation. We seldom find this to be realized however; the large refinery is found to be usually better equipped for obtaining every last heat unit out of fuel oil and making it do some useful work, and refining costs are therefore lower. But this is not due wholly to size as noted above; it is due to the better understanding of the economics of refining; willingness to use more staff, rather than to trust to rule of thumb.

Even though one plant may use less fuel oil per barrel of oil refined it does not follow that this plant has a more economical method of firing, or that its boilers are generating steam with higher efficiency, for the use of steam is one thing and the generation of steam another. To substitute electric power for steam, or engines running on gas or oil fuel, reduces steam consumption, true, but the boilers may still be running at a loss. The true measure of boiler economy then is not in the percentage of fuel oil used, but must be taken at the boiler under daily running conditions and separated from every other phase of plant operation.

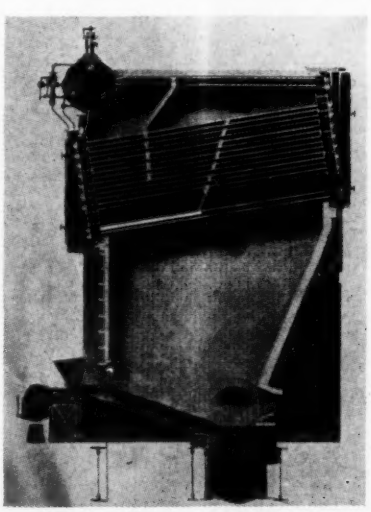


Figure 6.—Heine cross drum boiler. Note Height of section.

The operation of some refineries reminds the writer of a giant sifter into which everything is dumped and, after vigorous shaking, what is left on it belongs to the operator. Sometimes there is nothing left; the sifter has too large meshes and lets portions through that might be retained.

When oil is burned, it must first be vaporized before it can mix with air and ignite. The temperature of ignition is about 800 F. average, and, if the oil vapors contact a cold surface, reducing the temperature of unburned vapors below the temperature of ignition, the vapors so cooled pass out of the stack without benefit. Consequently, the furnace must be of such size and shape that its temperature is maintained high, with sufficient volume to completely consume the vapors of oil, mixing with air.

The flame temperature ranges from 2500 degrees F. to 3200, and since the temperature of the sheets and tubes of a boiler at 150 pounds gauge pressure is 366 degrees F., when the hot flame and vapors strike these relatively cold surfaces, there is no further combustion because the vapors are cooled below ignition temperature. The ideal furnace is one in which there are no cold spots and all furnace design is directed to this end. While the boiler manufacturer does not furnish the materials for the furnace, still he is concerned with the furnace in securing the

(Continued on page 32)

Smith's Bluff Plant Built in Units

Pure Oil Company accomplishes harmony by coordinating distinct refining activities

By Grady Triplett
Staff Representative

IN ITS plant at Smith's Bluff, the Pure Oil Company has followed the unit scheme of refinery construction. The units, however, are devoted to continuous operation. The plant is constructed for turning out gasoline and fuel oil from Mexia crude oil. Kerosene also can be cut, if desired.

So in output this plant of 15,000 barrels daily capacity is similar to one of the skimming type. But its equipment and its methods differ from those of ordinary skimming to such an extent that around 70 per cent of the crude is converted into motor fuel.

There are three units of the refining process. A battery of tube stills take the crude oil from the tanks. These divide the crude into four products. Two of these then go to the cracking stills, 26 in number. Benzine from both the tube stills and the cracking stills then pass to the battery of re-run stills for conversion into gasoline.

By devoting each of these three units to a distinct part in the whole process the continuous operation is accomplished. This also eliminates the common practice of using one set of stills for perhaps two stages of the refining of gasoline.

Ground plans of the plant are also such that additions can be made to either existing unit without disturbing existing equipment. Capacity of the plant could be doubled without hindering operation of the present units and that much new construction would still leave the unit feature.

All Units

The unit scheme of construction is carried much further than the construction of refining equipment. From the pump station for water on the Neches river to the loading racks for finished products, the equipment is so arranged that any distinct phase of activity is restricted to a definite building or plot on the grounds.

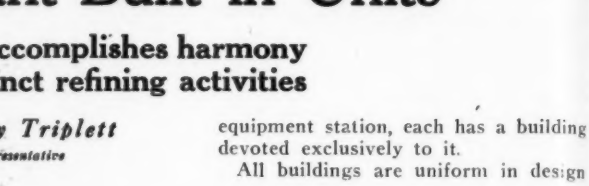
All water from the river is pumped from one station of four electric driven pumps of 2500 gallons each. The pumps for delivering oil to the stills, moving refined oil from one unit to another, or delivering it to the tanks are all within one building. Steam comes from one boiler house. The office has one building. The laboratory is under one roof. The warehouse is seggregated from other buildings. Even the workshop is divided into rooms, each being devoted to a separate class of work, such as pipe fitting or electric work. The welding force has its own shop, which is removed from other mechanical activity.

The acid house, the ice plant, the gate house, fire equipment station, each has a building devoted exclusively to it.

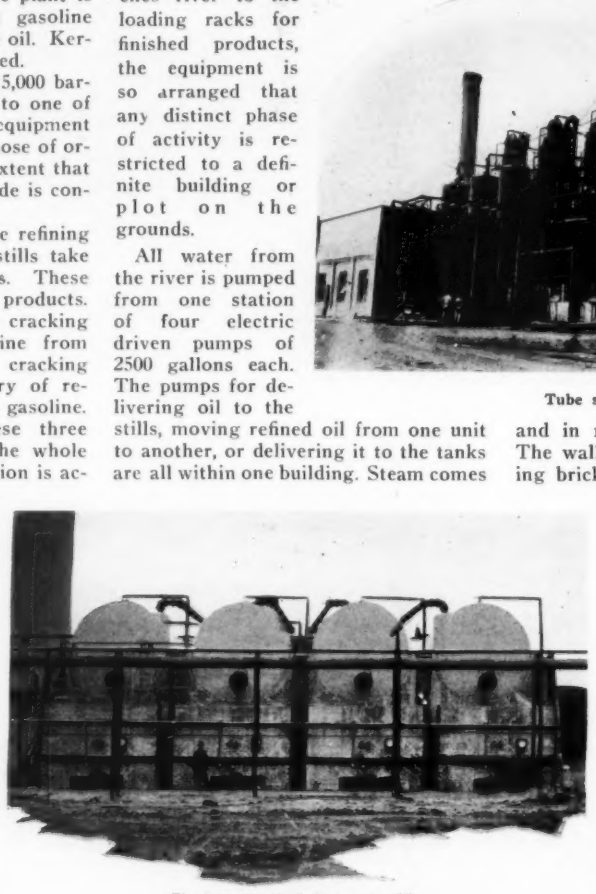
All buildings are uniform in design and in material used in construction. The walls are of second class red paving brick with white mortar, giving a rugged appearance. The paving brick is stronger than ordinary red paving brick. The wall brick is classed as second for paving purposes, as it failed to stand pressure tests required of paving brick.

Steel roof trusses carry directly to the brick walls. The roofing is corrugated asbestos sheets with ridge rolls and ventilators of the same material. Window and door frames are metal covered. Wire inserted glass is used in all windows. This type of construction has served to reduce wood to a minimum amount, giving added fire protection.

The plant has a complete Foamite extinguishing system. In addition to the outlet, under pressure from the central station, portable extinguishers are located at convenient points, while hand extinguishers are in all buildings. In this connection it may be well to add that several fires have threatened the plant but none has done serious damage, so efficient have been the fire-fighting equipment and the men drilled in handling it.



Tube still unit



The battery of shell re-run stills

Cross cracking units with crude oil tanks in the background

Texas Outlet

Construction of the Pure Oil plant on the Texas port followed the entry of that company into Texas, through its transaction with the Humphreys Petroleum Company for the Mexia acreage. Later the company acquired holdings in the Powell field. As an outlet for its production and purchases in

Central Texas, a tank farm site was bought at Smith's Bluff and a pipe line of 220 miles built from the producing fields to the point at tide water.

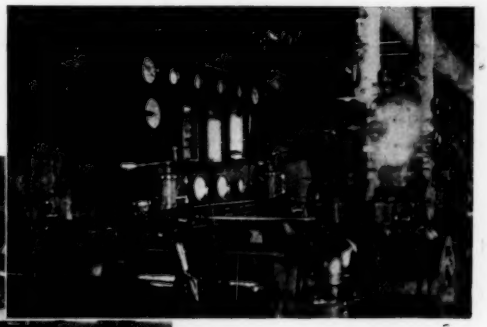
Smith's Bluff is on the south bank of the Neches river between Beaumont and Port Arthur. It is one of the ports of the Sabine district at this point on the Texas gulf coast. Others are Beaumont, Orange, Sabine, Sabine Pass, Port Neches, Atreco and Port Arthur. Within these Sabine ports is the world's largest refining center. If pressed, the plants of the Gulf Refining Company, The Texas Company, Magnolia Petroleum Company, Pure Oil Company and other smaller concerns could handle around 200,000 barrels of crude oil daily.

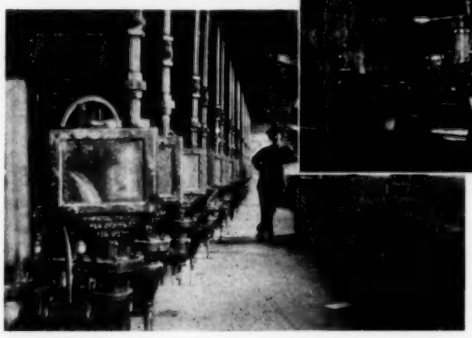
The site for the Pure Oil plant and tank farm for crude oil comprises 800 acres. It has 5,400 feet of river frontage, of which 1,500 feet is "high bank". The plot extends back two miles from the river. Depth of the river will permit passage of vessels drawing 25 feet of water. Work is under way at dredging the channel to permit passage of vessels of 30-foot draft. At present some tankers cannot load to their full capacity at Smith's Bluff for lack of sufficient depth.

Elevation of the plant site is 17 feet above mean low tide and five feet above the highest recorded level of the river. Gravity drainage has been accomplished through ditching.

Refining Method

Nine months after construction was begun April 5, 1923, the plant was running its first crude. Within this time all drainage work, road construction and rail facilities had to be built. Part of this construction period ran into a season of excessive rain. So the record of building is one of which the company is justly proud.





Upper—Control house of cracking still.

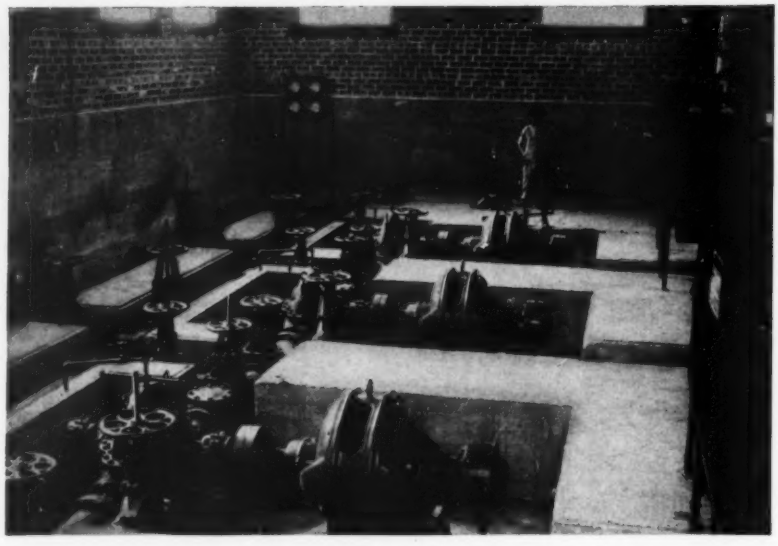
Lower—Receiving house from tube stills.

The principal refining units of the Pure Oil plant are three Foster tube stills of 5,000 barrels capacity each; 26 Cross cracking stills; eight standard shell re-run stills; and five 1,000-barrel agitators.

Crude oil is heated to 750 degrees Fahrenheit at atmospheric pressure in the tube stills. About 90 per cent of it is vaporized at this temperature and passes through the separating tower into the Southwestern condensing sections. The fuel oil is drawn from the bottom of the separators, leaving the vapor to pass through the condensing sections and then in four streams into the receiving house, as a small stream of gasoline, benzine, kerosene distillate and gas oil.

The small amount of gasoline is run to the tanks for treatment. Benzine goes to the run-down tanks, while the kerosene distillate and gas oil is passed to the Cross cracking units, to be run under pressure. When run through the cracking units, these two products are converted into benzine and fuel oil, this latter being stored with the fuel oil from the tube stills. The benzine goes

General view of the Pure Oil refining plant at Smith's Bluff.



Three of the four pumps which furnish water from the Neches river.

to the run-down tanks with the benzine from the tube stills. This benzine from these two processes is then ready for re-running in the shell stills, after being treated. From the shell stills it is sweetened and put in the finished stock tanks, for delivery either to vessels or tank cars.

The boiler plant has four Geary tube boilers, each of 5,000 horsepower, set in batteries of two. They are built for working pressure of 160 pounds. They have Foster superheaters, designed to give 100 degrees Fahrenheit of superheat when the boilers are working at 150 per cent of rating. The refinery as operated at present requires from 1,500 to 2,000 boiler horsepower.

All movement of finished oils either to tank car or vessels, as well as transferring, is through a central pump house. The pump station has 11 centrifugal pumps, three of 3-inch dimension and eight of 4-inch dimension. Each pump is driven by electric motor, direct connected. As a precaution against fire, the motors and pumps are separated by a 9-inch brick wall, the shafts extending through the wall. The large pumps have loading capacity at shipside of 5,000 barrels per hour. Pumps at the tank farm can load crude oil into tankers at this rate.

All power for the refinery is electric. Current is purchased from the East Texas Electric Company, which has a high-tension line from Beaumont to Port Arthur.

The following paragraph is from an article by E. M. Tharp in a recent issue of the Pure Oil News:

"This power has made possible a new and interesting development for refinery operation in the use of a General Electric B T. A. variable speed A. C. motor, which is in operation on a rotary pump charging the Foster tube stills and on the triplex power pumps charging two of the Cross units. This motor has a speed adjustment, without waste of power, from full to one-third speed on graduations as fine and more uniform than can be obtained by use of a throttle valve on a steam pump. The cost of pumping oil in this manner is probably less than 20 per cent of the cost with direct acting steam pumps."

Motor side of oil pump station. The brick wall separating motors from pumps is a precaution against fire.

Four loading lines run over the docks at Smith's Bluff. Ships berth parallel to the dock.

Two Water Sources

Rail connection with the Smith's Bluff plant is over the main line of the Kansas City Southern from Beaumont to Port Arthur. A spur off this line runs to the plant. This is 9,000 feet long. Another 6,000 feet of trackage is given over to a switch for the warehouse and two lines for the loading racks. The loading racks have space for 50 cars. All products of the plant can be loaded into tank cars.

Refinery tankage consists of five 10,000-barrel tanks and 22 5,000-barrel tanks. They are all-steel tanks of gas-tight construction and equipped with special vents and fire-prevention apparatus. These tanks are used for operating and for storing finished products. Fuel oil is carried at the terminal tank farm, which has lines to the refinery.

Two water sources are available. During ordinary stages of the river, boiler water is taken from the stream, as it contains only three per cent of salt. But when the river is low, the amount of salt increases to the point that the water is not desirable.

Four wells, each 600 feet deep, serve during such periods. These wells are used throughout the year for water for the houses and for making ice.

The ice plant is 5-ton capacity. The freezing tank holds 12 tons and storage is provided for 15 tons. The ice is available for ships, for refinery use and for sale to employes.

A gasoline pump with underground storage is near the gate house. Ground is provided there for employes' cars and gasoline is sold them.

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(BE SURE TO CHECK CLASSIFICATION)

Worthington Diesel Test Successfully Completed

A successful thirty-day, full-power no-stop test run of the new Worthington double-acting two-cycle Diesel type oil engine came to a conclusion on Saturday evening, October 25, in the Worthington Corporation's Buffalo shops. In the presence of a number of distinguished engineers, representing the U. S. Shipping Board, the Navy Department, and large private interests, the engine, which had been running under full load at a uniform speed of 90 revolutions per minute since 10:05 p. m., September 25, was stopped at 10:05 p. m. precisely.

The following morning, again in the presence of the Shipping Board and other representatives, the engine was started, stopped, run in reverse, again run ahead and stopped, handling in every case with perfect ease and precision, although it had not been touched since the end of the thirty-day run.

Following this, the valves were removed, the upper cylinder taken out and lowered to the shop floor for inspection, and the piston and rod also removed for inspection and gauging. One hour and twenty minutes sufficed from the time the engine was stopped to the time when it was entirely open for inspection.

An unusual feature of the inspection was the confidence shown by the Worthington engineers, in permitting the Shipping Board and other representatives not only to be present, but to be first to examine the cylinder, piston, rod and other details after the run. Usually, when such an important and severe test is made of a new engine design, the owners quite naturally prefer to make sure for themselves that everything is all right before inviting guests to inspect the engine interior condition.

The engine, cylinder, liners, piston and rod were all in perfect condition. Piston rings were all as free as when originally put in, and there was not a mark or a score on any surface. Micrometer gauging of the liners and the moving parts revealed no wear at any point exceeding a thousandth of an inch, and at most points less than one ten-thousandth of an inch. There was some little soft carbon deposit in the lower edges of the upper exhaust ports, but not sufficient to interfere with the engine operation or decrease its efficiency appreciably. Piston heads and cylinder heads did not even show discoloration from burning. The closest inspection failed to disclose any untoward condition.

Plant Operating

It is reported that the Gustaveson Oil Company has completed and placed in operation a 500-barrel topping plant at Virgin, Utah, that will run on crude oil from the Washington County field in that section.

W. M. Welch Considering Plans for Jobber Business

Tulsa, Okla., Nov. 15.—W. M. Welch, first president of the Association of Natural Gasoline Manufacturers, is considering early entry into the marketing business. In his preliminary plans he is striving to work out means of bringing about closer co-operation between jobbers and refiners.

Mr. Welch was instrumental in organizing the Tidal Refining and allied companies, and as general manager of these companies, developed them from a small beginning in 1916, to one of the leading groups of refining and natural gasoline companies in the Mid-Continent field. He has not yet announced his plans in detail, but it is understood that he will make his headquarters in Tulsa, with representatives in the important marketing and refining centers.

Refinery for Alberta

Operating under a charter from the Canadian government, the Great West Producers and Refinery Company has been organized and the construction of a refinery is contemplated at some point in southern Alberta. The plant will operate on Irma-Wainwright crude oil.

The United States Refining Company at Osage, Wyoming, is increasing the charging capacity of its plant there 250 barrels a day giving the refinery a total capacity of 1000 barrels.

Uses Lead Gaskets for Hand Hole Plates

By adopting lead gaskets for handhole plates for the four boilers at the Smith's Bluff refinery, the Pure Oil Company made a saving calculated at $6,350 each year.

George M. Bowers, writing in the Pure Oil News gives this information on the use of lead gaskets:

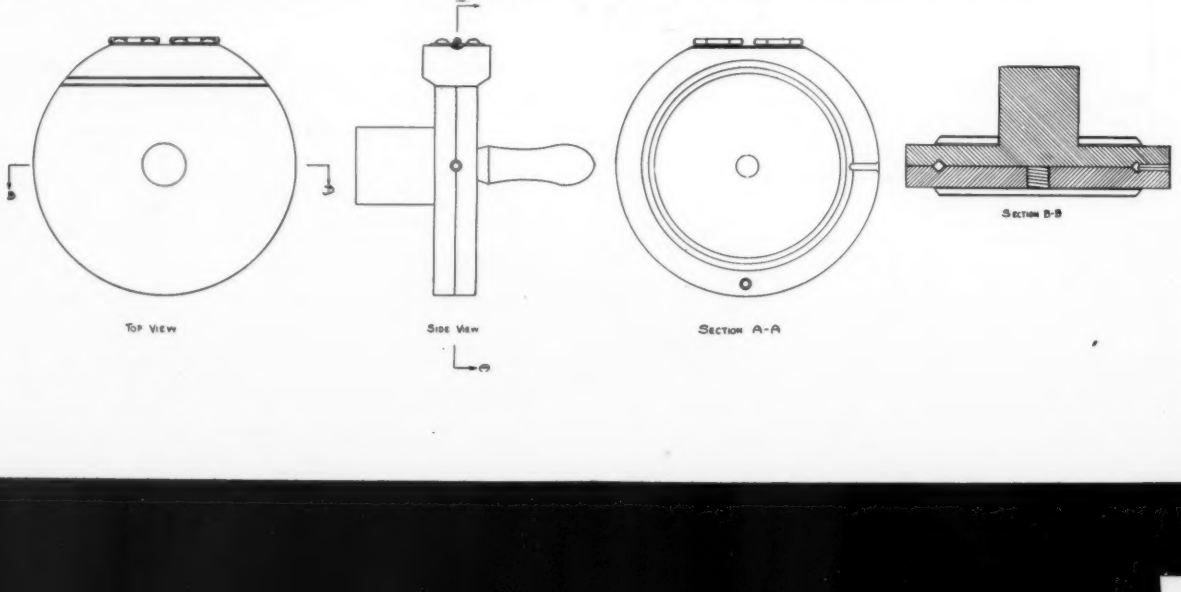
"In the operation of our four steam boilers, it was our custom to remove all handhole plates once each month for cleaning the tubes. The removal of the plates, scraping the old gaskets from the plates and headers required several days labor for a gang of men. Our Clyde L. Jones does not lay claim to originality in the idea of using moulded lead gaskets for this purpose, but it is due to his efforts in devising the mould and getting the gaskets into service that has resulted in a closely estimated labor and material saving of $1,587.50 per boiler per year over the old method previously used.

"The above saving is made up of three quarters of the total man hours previously required, and to the fact that the lead gaskets can be remoulded at a nominal charge."

The mould for the gaskets, drawings of which are shown herewith, was made in the shops of the Pure Oil plant. Then a supply of soft lead and a plumber's torch completed the equipment. The gaskets are moulded in the boiler plant and a supply kept ready for cleaning the tubes.

As the handhole plates are removed, the old lead gaskets are taken out and piled up for remoulding. Instead of scraping the plates to remove the former type of gaskets, the lead ones are removed easily and new ones put in place. The old gaskets, mashed out of shape with each using, are almost 100 per cent salvage, as they can be melted and moulded into new gaskets.

The lead gasket has been found a better product against leaks. It is cheaper. It saves time.



Temperature Regulation for Towers

Efficiency of fractionating towers and reflex condensers is assured through temperature instruments

By W. C. Begeebing

IT has only been in the last few years that efficient fractionating towers and reflex condensers have come into general use, although far-sighted operating men and technologists had predicted this necessary development before its adoption. Tower construction has been greatly improved in a relatively short time and in conjunction with this notable advance in refinery practice has come the widespread adoption of automatic temperature control.

The application of automatic temperature control to reflex condensers

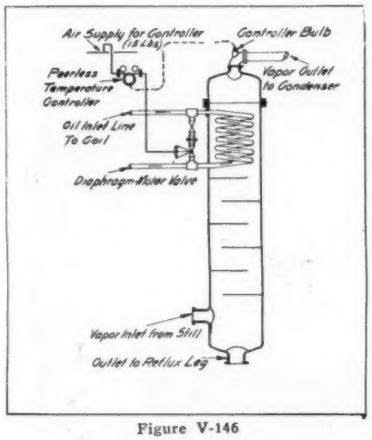


Figure V-146

and dephlegmating, fractionating and bubble towers has been in line with a general desire for more efficient and exact methods of operation. Moreover, the present practice of grading and marketing the lighter petroleum products on the basis of end point (rather than gravity) has made control of temperature the logical factor by which to secure uniformity.

In continuous distillation which is now generally employed, many considerations must be taken into account in securing cuts of the desired specifications. The nature of the crude, the firing temperature, the rate of heat transfer in the tower or partial condenser, the temperature and quantity of the feed—all these are important factors.

The last controlling factor, the temperature of the vapors leaving the towers can be exactly regulated by automatically controlling the cooling action in the tower and unless this is done undercooling or overcooling will occur in the tower even though the still temperature and the amount of cooling medium put through the tower are kept practically constant.

If the undercooling takes place, some of the higher boiling point products will pass out of the tower and these heavier ends will be present in the distillate. This will require rerunning or will result in a product not conforming to the desired specifications.

If overcooling takes place, products which should be allowed to go over will be knocked back. They will reflux back into the still or will be revaporized lower in the tower and will again be condensed and knocked down before they reach the tower outlet. This cycle of vaporization and condensation will continue as long as the cooling effect of the tower is too great. The result, of course, is the reduced yield of light product and a waste of fuel because of the inconclusive cyclic action.

Benefits of Control

By automatically controlling the admission of cooling medium to the tower so that the exit vapors are maintained at a constant temperature a uniform product is assured, rerunning may be eliminated, and a higher yield can be obtained. It would be idle to suggest, however, that this automatic temperature control of the tower makes it less important to maintain the proper still temperature or that a competent and intelligent operating force is thereby rendered unnecessary. But it can be claimed (on the basis of actual performance) that properly designed automatic controllers on tower regulation have eliminated one factor, which, before their installation, has been a source of inefficiency and trouble.

Most of the larger refiners and a great number of the smaller plants are now using automatic control for this

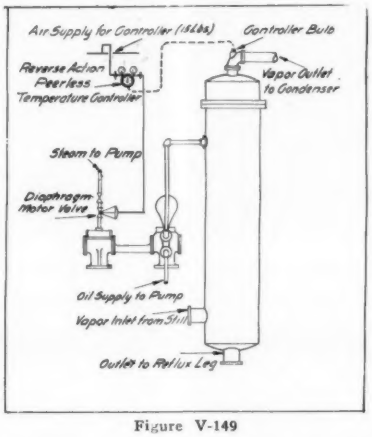


Figure V-149

purpose. This article will not disclose the details of installations in this work because of its confidential nature. Because of these limitations the accompanying illustrations have been made in diagrammatic form and details of tower construction have been avoided. These six diagrams together with the following explanation should serve, however, to make clear the method of control. These diagrams by no means cover completely the various possible arrangements of control but such a discussion is beyond the scope of this article.

In some towers the cooling effect is accomplished by charging cool oil into the top of the tower and by means of suitable baffling bringing it into intimate contact with the vapors which are admitted at the bottom of the tower and leave at the top. The cool oil

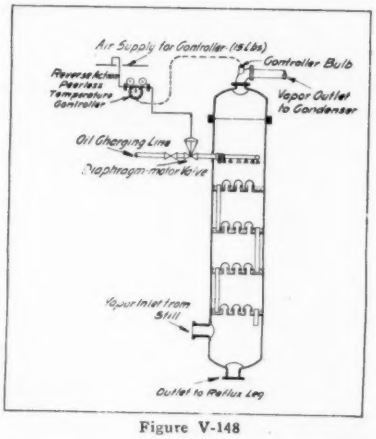


Figure V-148

condenses the vapor fractions with high boiling points and runs with them back into the still. This charging oil plus the condensed portions (reflux) supplies the still with the necessary feed for continuous running. The baffling in the tower may be checker brick work, broken tile, plate baffles, trays or bubble plates. In diagram V-148 bubble plates (as are widely used in alcohol work) are shown and this tower is consequently known as a bubble tower. The rising vapors bubble through the liquid on the plates which liquid automatically maintains itself by the overflow pipes. The overflow from plate to plate caused by the addition of fresh charging stock and by condensation of the high boiling point vapors overflowing the bottom plate and running back into the still.

Frequently distillate is introduced into the tower, the necessary cooling effect being obtained by this recycled stock. In conjunction with this the raw make-up oil is often fed in near the bottom of the tower.

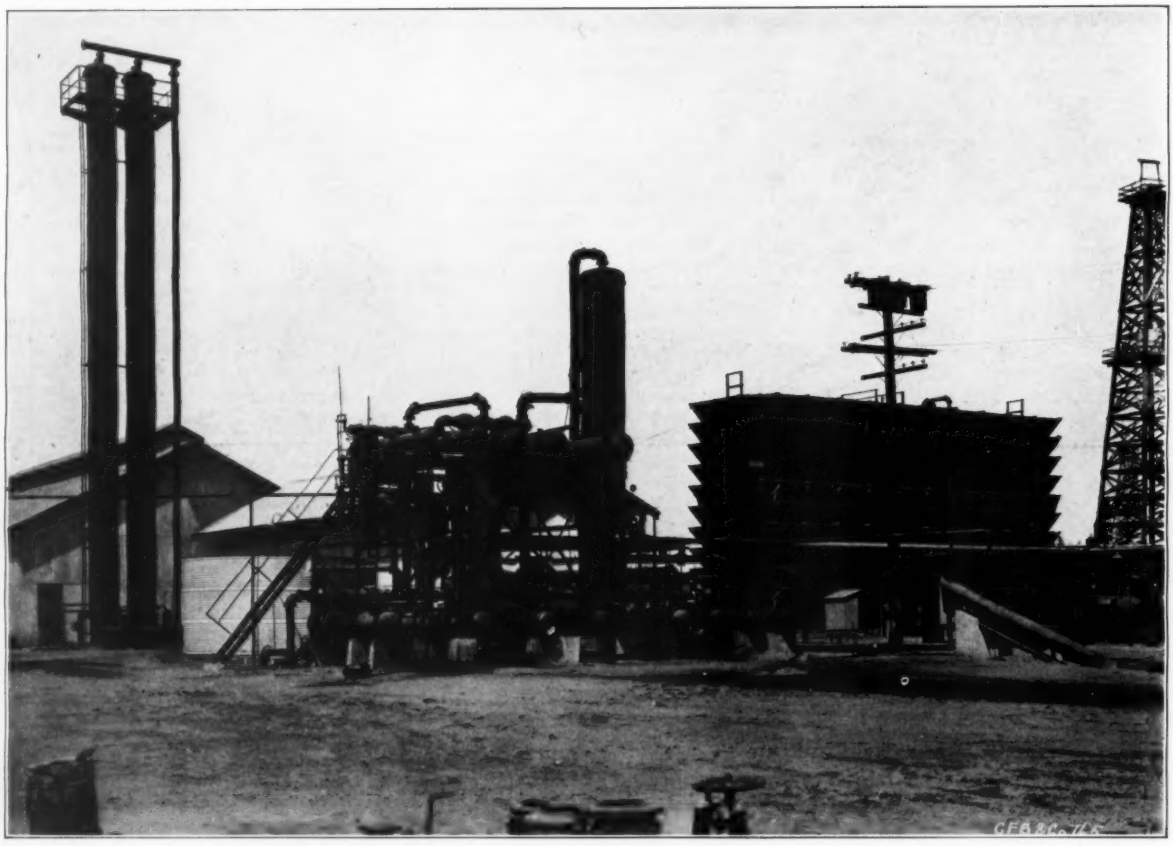
Control Method

Control is obtained by installing a diaphragm-motor valve in the oil line and inserting the bulb of a reverse-act-

(Continued on page 24)

Braun

Absorption Plants



Braun Equipped Absorption Plant showing Distillation Units, Gas Coolers, Water Cooling Tower, Absorbers, Etc., at Torrance, California

C. F. Braun & Co.

Manufacturing Mechanical Engineers
Factory & Executive Offices - Alhambra, Cal.
Midcontinent District Office - Tulsa, Okla.

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Braun

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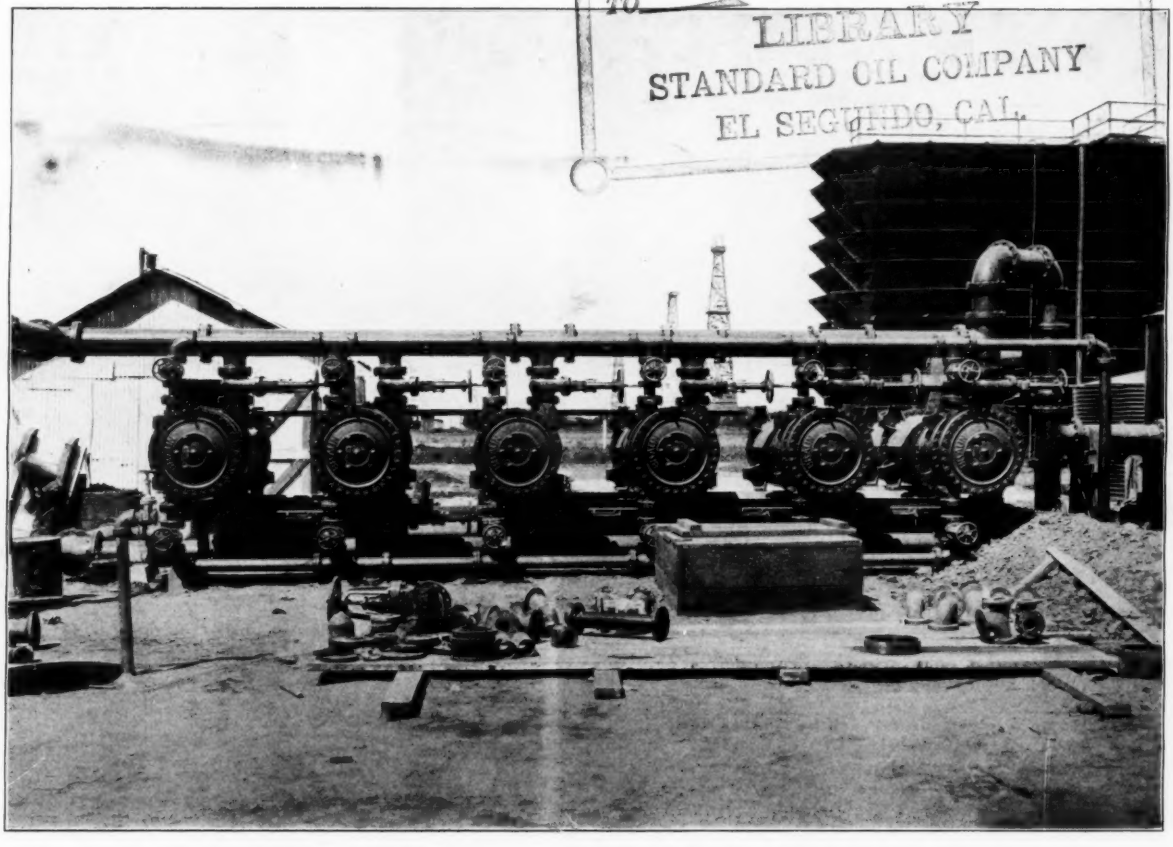

Braun Gas Cooler Unit at Santa Fe Springs, California. Capacity 30 million standard cubic feet per 24 hours

C. F. Braun & Co.

Manufacturing Mechanical Engineers
Factory & Executive Offices - Alhambra, Cal.
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Temperature Regulation for Towers

(Continued from page 21.)

ing temperature controller in the exit vapor line. If the oil charged into each tower is pumped by a separate pump for each tower, the diaphragm-motor valve can be placed in the steam line of

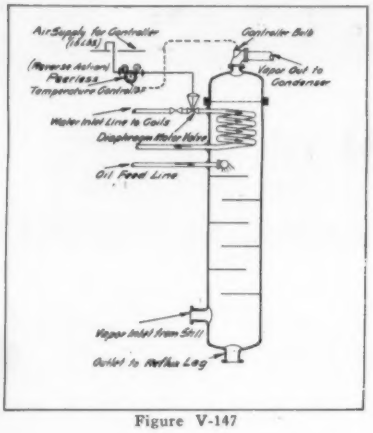
Air Supply for Controller (15 Lbs.)
Controller Bulb
(Reverse Action) Peerless Temperature Controller
Vapor Out to Condenser
Water Inlet Line to Coils
Diaphragm Motor Valve
Oil Feed Line
Vapor Inlet from Still
Outlet to Reflux Leg

Figure V-147

the pump and control secured by regulating the operation of the pump, as shown in diagram V-149.

As it is frequently desired to heat the charging oil fed into the still, the cooling of the vapors is obtained by circulating the oil through a closed coil at the top of the tower. Inasmuch as a constant feed is usually desired, it is necessary to provide a by-pass for this oil coil and control by placing a diaphragm-motor valve on the by-pass is as shown in diagram V-146. The bulb of the direct-acting temperature controller is placed in the exit vapor line. If the temperature of the vapors tends to increase, the by-pass is shut-off until all the oil is passing throug the coil in the tower. If the temperature of the vapors tends to decrease the diaphragm-motor valve o nthe by-pass is gradually opened, allowing part of the oil to go through the by-pass instead of through the coil.

In making an installation with the diaphragm-motor valve in the by-pass, there is one point which must be considered. In some cases the friction of the oil coil in the tower is very slight, being no greater than the friction of the valve in the by-pass. In other words, the resistance to flow presented by the coil is no greater than that offered by the by-pass. In such cases, installation should not be made as shown in diagram V-146 but the hook-up illustrated in diagram V-153 should be used. This arrangement utilizes two diaphragm-motor valves, a direct-acting valve being placed in the oil inlet line between the by-pass and the towers while a reverse-acting valve is placed in the by-pass. Both these diaphragm-motor valves are connected by air lines to the reverse-acting Peerless Temperature Controller. The regulation is as follows: when the temperature of the exit vapors tends to increase the diaphragm valve on the inlet line is opened and the diaphragm valve on the by-pass is closed thereby allowing the maximum circulation of cooling oil through the coil; when the temperature of the vapors tends to decrease the valve on the inlet is shut and the valve on the by-pass is opened so that the oil must go through the by-pass. This arrangement is positive in action and should be used except in cases where the coil resistance to flow is considerably larger than that offered by the by-pass.

For Water-Cooled Tower

A great many towers are controlled by circulating water through a coil at the top of the tower. Control is established by regulating a diaphragm-motor valve in the water inlet by a reverse-acting temperature controller with its bulb in the vapor exit line. The steam generated in this coil is frequently used elsewhere in the refinery so that there is no loss of heat economy by this method. A typical method of installation is shown in diagram V-147. Another type of water-

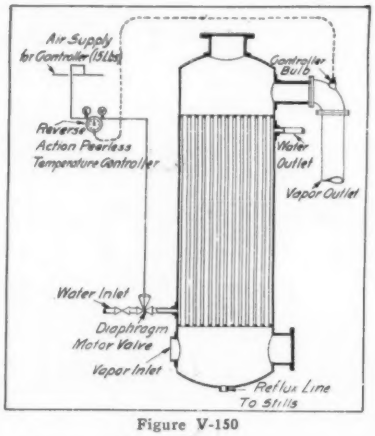

Figure V-150

cooled tower is shown in diagram V-150.

This type of tower is rapidly becoming obsolete since so many uncontrollable factors can affect its operation. Changes in atmospheric temperature or a sudden rain will greatly alter its cooling effect. Automatic control can be arranged if the tower is provided with adjustable damper arrangements which can be opened or closed by a diaphragm-motor lever. No illustration of this type of tower is shown because of the great number of different designs and the relatively small number of such towers in use.

Other Types of Towers

Very often the towers are a combination of the types already covered. That is, they will be fitted with both a water circulating coil and an oil circulating coil. In this case control of the water coil usually is entirely sufficient to maintain the desired vapor temperature. Sometimes the towers have a water circulating coil and an oil charging spray and here again control of the cooling water inlet provides the temperature regulation desired.

The proper selection of controller equipment is a simple matter, but one which requires care in including all the essential facts. A model questionnaire would embrace the following points:

(1) How will the controller be installed? It is suggested that a rough sketch or blue print of installation be prepared in this connection.

(2) What length of connecting tube will be needed to reach from the bulb-stem to the controller case?

(3) What temperature is to be maintained?

(4) What range of temperature setting point adjustment is necessary? Please state the narrowest range possible because when a wide adjustment range is furnished the controller is less sensitive.

(5) What is maximum length of bulb-stem that can be placed in vapor line (or wherever the bulb-stem is to be inserted?) See "Hints on Specifying Bulb-Stems."

(6) What kind of liquid will be regulated by diaphragm-motor valve?

(7) What is the pressure of this liquid and to what extent does this pressure vary?

(8) What is the maximum temperature of this liquid?

(9) Is clean and dry compressed air available for the controller? If so what is its pressure?

Bulb-Stem Length—When used in contact with vapors, the longest length which can be readily accommodated should be specified and the bulb-stem should be installed so that it will be directly across the path of the vapors.

Separable Sockets (Wells)—In continuous processes where it is impossible to open the apparatus to the atmosphere during the run, the use of a steel separable socket (well) is recommended. The separable socket is

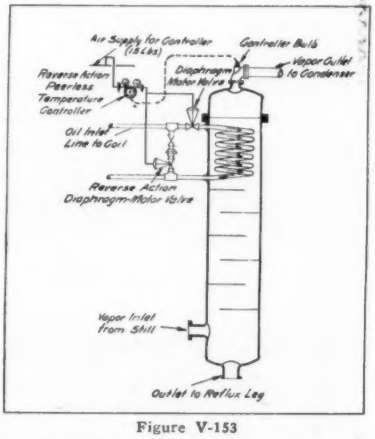
Air Supply for Controller (15 Lbs.)
Controller Bulb
Vapor Outlet to Condenser
Diaphragm Motor Valve
Reverse Action Peerless Temperature Controller
Oil Inlet Line to Coil
Reverse Action Diaphragm-Motor Valve
Vapor Inlet from Still
Outlet to Reflux Leg

Figure V-153

screwed into the apparatus and the controller bulb-stem fits into it. Should any accident happen to the controller, it can be removed from the apparatus inasmuch as the socket remains to keep the apparatus closed to atmosphere.

(Continued on page 30.)

Tank Cars
for All Purposes

THE next few months are sure to bring better business; in fact, revival already is manifest. Once more, therefore, we advise our customers to cover now for future tank car requirements. Orders placed now will protect against higher prices and insure delivery as desired.

Buy for YOUR profit—for dependable operation, lowest upkeep, longest service. BUY "CAR FOUNDRY" CARS.

Always get a "Car Foundry" quotation

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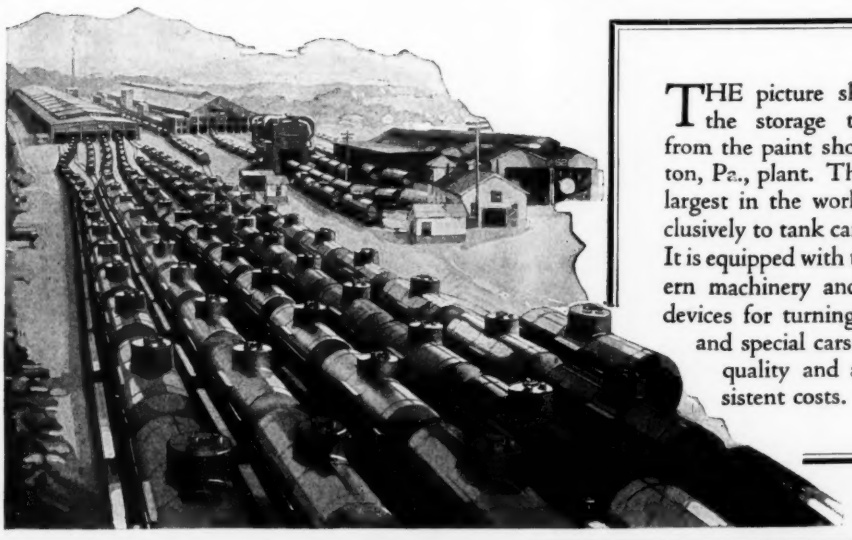
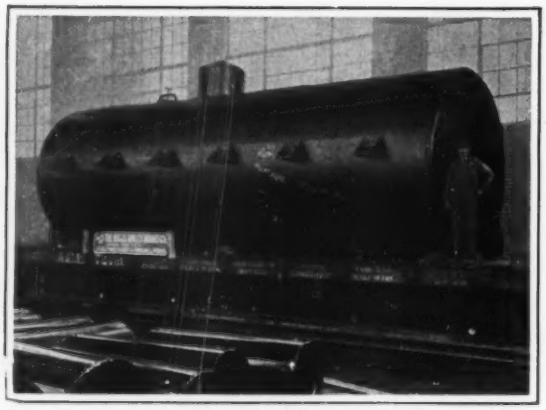
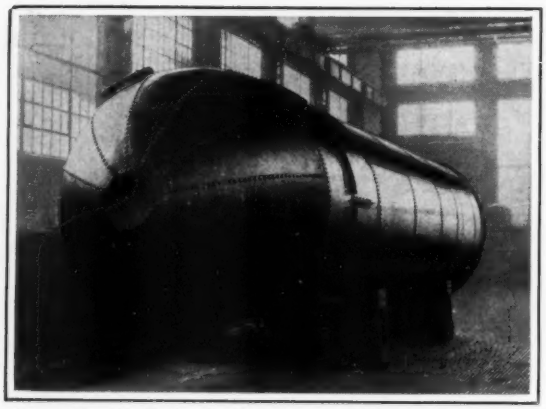


THE picture shows some of the storage tracks leading from the paint shop at our Milton, Pa., plant. This plant is the largest in the world devoted exclusively to tank car manufacture. It is equipped with the most modern machinery and labor-saving devices for turning out standard and special cars of unequalled quality and at lowest consistent costs.

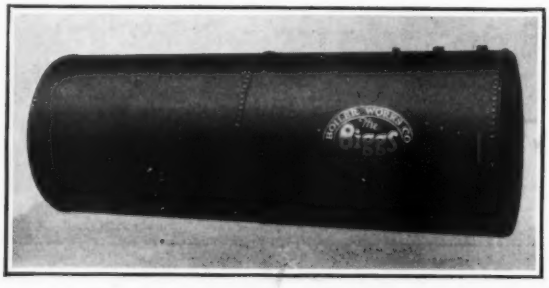
BIGGS



Biggs Oil Still on flat car ready for shipment. The exceptional quality of our riveting methods is an important factor in this class of work



Agitator on test block. In the severe test which is given here, long and satisfactory service to the buyer of Biggs equipment is assured



Biggs Riveted Steel Tanks, Every Size, Every Purpose

Biggs 55,000 Bbl. storage tank in process of construction on Oklahoma oil field.

Field Storage and

Tell them where you saw the ad

TANKS

What's Under the Hood?

IN appraising a motor car you have learned to judge not so much by external appearance as by those other factors popularly characterized as "What's under the hood". In other words, the inbuilt quality of the chassis itself, which will determine the performance and life of the car.

So with tanks, stills and other steel plate equipment. Are you just buying so much steel, of a certain size and shape, or are you looking "under the hood", to determine whether the equipment is a real investment?

Whether you require tanks for filling stations, bulk storage, or complete refinery equipment, including 55's and 80's, Biggs is one source of supply that you can't afford to overlook.

We would like to have you look "under the hood" in the Biggs shops, and see why we can claim so much for Biggs equipment. On price and delivery, too, our splendid facilities are a decided asset to our customers. We carry standard sized tanks in stock for immediate shipment.

THE BIGGS BOILER WORKS COMPANY
Akron, 42; Ohio

Specialists in Riveted Steel Plate Equipment

BIGGS PRODUCTS FOR FIELD STORAGE AND REFINERY EQUIPMENT

Storage tanks of 55,000 and 80,000 barrels capacity
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Pressure Stills for Cracking Process
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Crude Stills, Condenser Boxes
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High Pressure and Accumulator Tanks
Direct Heat Driers

"Biggs Riveted Tanks — Made Right, Always Tight"

Refinery Equipment

Tell them where you saw the ad

Record Set in Welding Magnolia Gas Line

Huge main will be moving gas from North Louisana to Beaumont refining center in 30 days

By H. H. King
Staff Representative

BY completing 215 miles of 14 to 19-inch welded pipe line in four months, crews of the Magnolia Gas Company have set a record for this class of pipe line construction. This line, from Cotton Valley, Louisiana, to Beaumont, Texas, will be transporting gas within 30 days.

This company is a subsidiary of the Magnolia Petroleum Company. The line will supply fuel for the Magnolia refining plant at Beaumont and the topping plant at Magpetco on the Neches river, 10 miles below Beaumont. It will deliver 50,000,000 to 65,000,000 cubic feet of gas daily. This will permit the company to use gas for fuel instead of oil. Surplus gas may be sold for commercial use to cities and towns along the route and to other refining plants in the Beaumont district.

The project represents the most extensive piece of welded pipe line construction ever attempted. The cost will reach around $8,000,000.

Above—Pulling welded section of line into place for tying into completed line.

Right—Welding 18-inch pipe, showing clamps holding ends in place.

The welding of the line was completed several months in advance of estimates, resulting in a saving in the cost of the line and affording a quicker market for the abundant gas production now available in the fields to be served by the line. When the first welding crew began work on the line near Kirbyville, Texas, on June 15, 1924, it was believed the line would not be in full Texas unit early in December. The pleted and ready for operation of the other station on the line located near the Texas-Louisiana border will be completed in time to start operating full capacity by January 1.

The line was built and will be operated under the name of the Magnolia Gas Company, which was organized early this year under the laws of Delaware with a capital stock of 100,000 shares of non-par value. Fred M. Lege, Jr., of Dallas, formerly with the Lone Star Gas Company, is president of the Magnolia Gas Company, and has peroperation with both booster stations until March 1, 1925. Present indications are that one station will be comsonally supervised the construction of the line.

Pipe Sizes Vary

Three different sizes of steel pipe were put into the line, with a greater part being made up of 16 and 18-inch pipe, while a 15-mile stretch of 14-inch pipe was placed at the upper end of the line in Louisiana and for the same distance out of each of the booster stations, making a total of 45 miles of 14-inch line. The 16-inch pipe was divided into three sections along the route, with a total length of 99 miles, while 71 miles of 18-inch pipe was used in approaching the Magasco station and entering the Beaumont terminus. The weight of the pipe varies from 42 to 63 pounds, with the heaviest weight being in the 14-inch pipe in order to withstand the pressure put on the gas coming out of each station. In order to obtain maximum capacity with the smallest amount of steel, 12 different weights of pipe were used in each section between stations, thereby effecting an appreciable saving in pipe costs. The pressure behind the gas coming out of the stations will be about 450 pounds, while a pressure ranging from 50 to 100 pounds is expected on the Beaumont end of the line, depending on the amount of pull. The gas will flow into Beaumont at a rate calculated to reach a speed of 35 to 40 miles per hour.

Natural pressure of gas wells in the Cotton Valley field will be used for a while in boosting gas through the 15 miles of 14-inch line and 38 miles of 16-inch line to the first station at La-Tex, near DeBerry, Texas. From the La-Tex station 15 miles of 14-inch pipe extends south to the Watterman Road, and then 30 miles of 16-inch pipe is used to Clark's Mill, followed by 31 miles of 18-inch pipe into the Magasco station. From the Magasco station 15 miles of 14-inch line feeds into a 31-mile stretch of 16-inch about three miles south of Horton, and at Call Junction the gas flows into the last section of 18-inch pipe and then on to Beaumont, a distance of 40 miles. Since the completion of the main line, work has been started on an extension line from Beaumont to Magpetco, where Magnolia Petroleum Company recently completed a 15,000-barrel topping plant. This extension line will be 10 miles in length, and is made of 12¾-inch pipe, with all joints welded.

Welders Trained

Oxy-acetylene flame was used in the welding of this gas carrier, and in or-

der to obtain the necessary number of welders to carry out the big job of welding more than 67,000 joints in the line, a special school of welding was opened at Beaumont by the Magnolia Company to train men for the work. Every welder on the job was a product of this school, although experienced men required only a few minutes to pass the test, while the average novice qualified for duty after training for 10 days or two weeks.

In order to expedite the completion of the line before the rainy season set in welding gangs were scattered at various points along the route, and at times as many as 220 welders were at work on the line. After completing a stretch of line these gangs were often transported by special trains, with equipment, to other points as a means of saving time and to keep the gangs intact while moving.

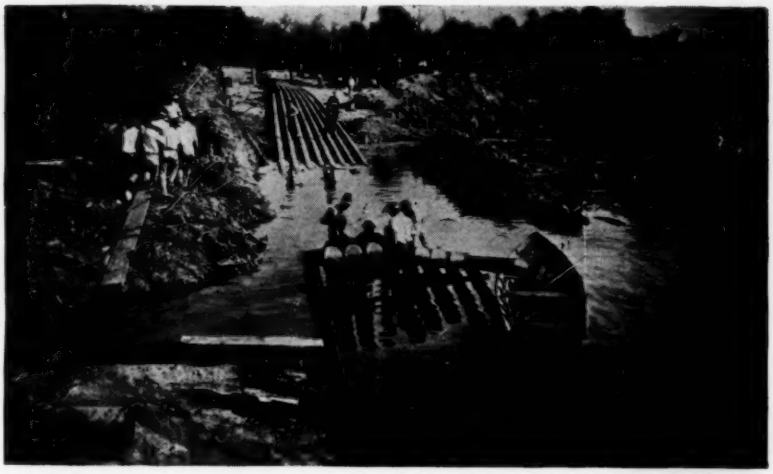
The line as it now stands has been tested in sections for its entire length with air, and water whenever available in sufficient quantities, and officials of the Magnolia Gas Company state that 95 per cent of the welds made on the line will stand the same pressure test that the pipe was subjected to before leaving the steel mills. The preliminary tests made of the line in sections shows a higher efficiency than 95 per cent, but the builders expect to develop more defects after a few weeks' operation of the line.

Not one fitting or threaded connection is used on the line, while expansion joints are used only at the river crossings. To avoid the use of expansion joints and at the same time allow for contraction and expansion the line was made sinuous before being put into the trench. A small tractor was used to throw about three feet of slack in the line at 100-foot intervals, thereby giving the line the appearance of a long snake. The trenching work will not be completed until late in November, and the pipe is to be buried not less than 20 inches.

The route traversed by this gas line leads through numerous swamps, across streams, and through the heart of the East Texas timber belt, making it desirable that the line work be completed before winter rains began. A corduroy road of logs had to be built for many miles in crossing the swamps, while the heavily timbered areas necessitated the cutting of paths and the dynamiting of thousands of stumps to permit the passage of ditching machines and welding equipment. Because of the swampy condition of a large percentage of the land covered by this line, it was reported that only a welded line could be used satisfactorily.

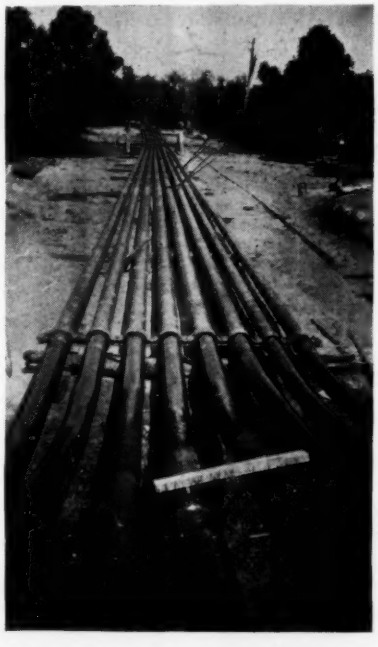
Insulation Thorough

Extreme precaution was taken to protect the line from the briny waters found in the swamp regions. Every foot of pipe has been covered with a coating of special asphalt primer followed by a layer of asphalt cement. The third treatment consisted of a blanket of asbestos felt saturated with asphalt, plastered around the pipe, hermetically sealing it. An extra heavy coat of asphalt was then applied to the asbestos conduit as final means of protection to the pipe.



Plugged ends of river crossing ready to be pulled into channel across the Neches

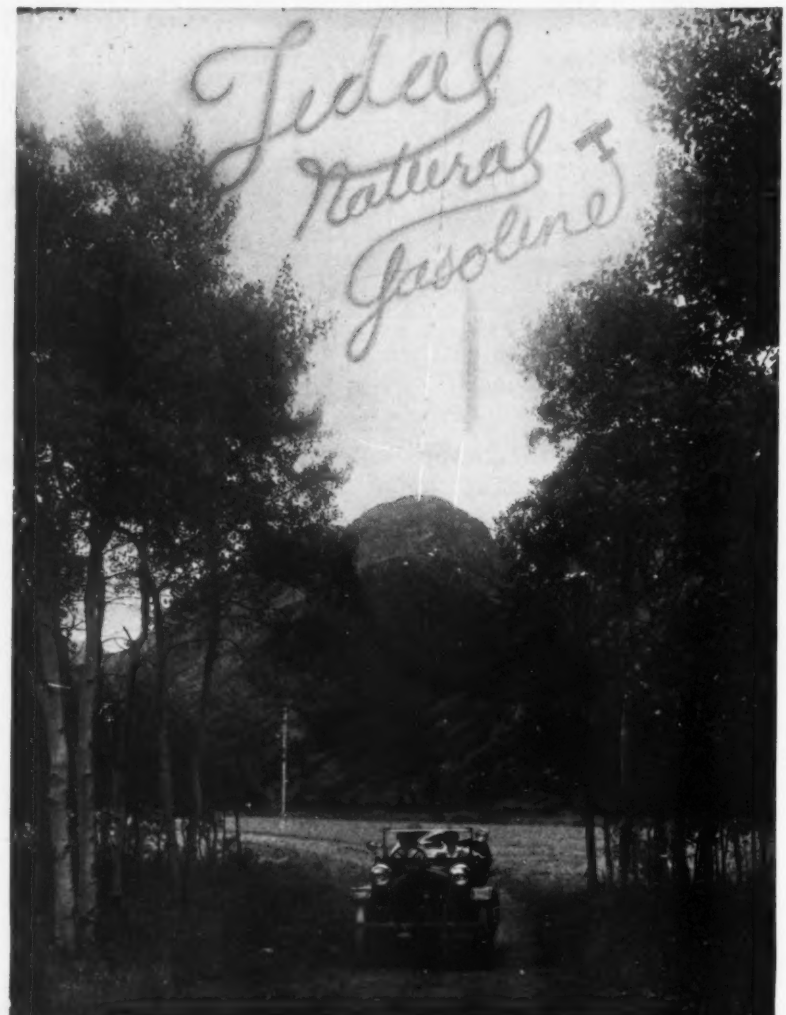
The most difficult river crossing encountered by the line was on the Neches at Beaumont, where maritime traffic could not be interrupted. The 18-inch main line was substituted at this point for six 10-inch and two 8-inch lines. These eight lines were welded for a length of about 800 feet, and bent so as to conform with the river bed when placed in a channel dredged across the river. The lines were laid parallel and fastened with clamps. Extra heavy pipe was used on this river crossing to give weight and strength, and replace the customary river clamps. A single two and one-half inch pipe was included to accommodate telegraph and electric lines. A channel about 40 feet wide at the bottom and 150 feet wide at the top and varying from 20 to 35 feet below the river bed was dredged for this network of lines. A tug was employed to drag the river crossing pipe across the stream into its specially prepared channel, but pulling power was lacking, and the job was completed through the use of a windlass made of pipe on the opposite bank with a large force of pipe liners turning the pipe windlass with tongs. This method was somewhat slow, but the river crossing was accomplished in a day and night.



Eight lines clamped together for Neches river crossing and bent to river bed contour.

The crossing of the Red river was made different, and the 16-inch gas line was divided up into four 10-inch carriers, which were planted about 400 feet apart in crossing the river bed. The 10-inch pipe was extra heavy and doubled in strength, thereby doing away with the need of river clamps. Since the banks of the river at the crossing were about 40 feet high it was decided to bore tunnels for the lines, rather than to "right of way" through them, and have the banks cave in in a few years after being disturbed from their natural state. The first attempt to bore through the river banks was made with a rotary draw works and rotary drill stem planted about 300 feet behind the bank. One hole was made with this equipment, but the remainder were bored with a specially designed auger operated by hand and a small tractor. Expansion joints were placed on the four separate lines making this river crossing, and the joints were specially designed by President Lege.

The two booster stations on the gas line are located at Magasco, two miles north of Pineland, and at La-Tex, near DeBerry. Both are equipped with 5,000 horsepower Cooper engines, and are identical in layout and equipment. A third station is to be erected next year



The best safeguard in obtaining gasoline conforming strictly to specifications is to buy from a company which has an established reputation for delivering a product which is all it purports to be. The Tidal Refining Company has such a reputation, built up by an ever-present purpose to serve its customers as it would wish to be served itself.

For 68-70 gravity, 360 end point;
64-66 gravity, 375 end point;
58-60 gravity, 437 end point; (Navy)
58-60 gravity, 450 end point;
Straight run;
Grades A, B & C natural gasoline,
and 41-43 water white kerosene,

Wire or Write

TIDAL REFINING COMPANY
TIDAL BUILDING—TULSA, OKLAHOMA
Subsidiary to
Tide Water Oil Company, New York
Makers of Veedol Quality Lubricants and Tydol Economy Gasoline

at the end of the line in the Cotton Valley field. The Magasco station is on a 160-acre site located on a group of small hills in the midst of a pine and hardwood forest, and a lake has been built to carry at least six months' water supply. The main engine building, auxiliary building and warehouses are of the latest type Austin Brothers' all-steel and brick design. Modern bungalow type of houses have been erected for the employes, with sewerage, gas, lights and water conveniences. The La-Tex station site consists of 137 acres, and accommodations for employes and the station proper is the same as the Magasco station. Both sites are to be beautified, and made into attractive places for the workmen and their families.

The completion of this gas line will be a boom to gas development in Northeast Texas and Northwest Louisiana fields, and its great carrying capacity will afford a large demand for gas, as Magnolia can dispose of all gas handled in excess of its current needs to cities, towns, industrial plants and to other refineries located near Beaumont. The nearest group of fields to Beaumont to be served by the line are in Panola county, Texas, the Bethany and Wascum fields, while the second group is located at Serepta and Cotton Valley in Northwestern Louisiana. Other fields are to be given connections if the production slumps in the above gas areas.

Temperature Regulation for Towers

(Continued from page 24)

However, where this advantage is not important, the separable socket should not be used inasmuch as it slightly decreases the sensitiveness of the controller.

Extension Necks—If the point decided upon for locating the bulb-stem is insulated, it is suggested that a 2½-inch (or 4-inch) extension neck be specified for the bulb-stem. This extension neck permits the bulb-stem to be secured to the apparatus without marring the insullation by the wrench-head or the wrench.

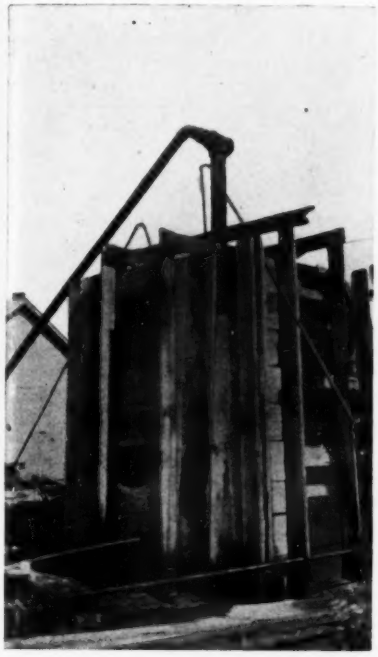
Material—Brass is the customary material used for the bulb-stem and is entirely suitable except where the vapors or liquids in contact with the bulb-stem are corrosive when steel should be specified. Aluminum, cast-iron, monel metal, stainless steel, calorized metal, copper or lead-covering can also be employed, if necessary.

To Build Plant

El Dorado, Ark.—A high pressure absorption plant is to be built by the El Dorado Gas Company on its gas line furnishing gas for the city of El Dorado from the El Dorado field. This gas line handles about five million cubic feet of gas daily during the summer months, and the load is doubled in cold weather. It is planned to build a plant that will strip about six million cubic feet of gas daily.

This Refinery is Free From Common Troubles

THERE is one refinery that is free of the problems so common to the industry. It had no drawbacks while building. Its crude supply is assured. Manufacture is no problem. Outlet is so good that the plant never had surplus stocks. There is no labor problem.



The "still", a discarded separator, is housed here.

The crude supply comes direct from the well into the still. As often as the still is full, the steam is turned in and a run is made. Week in and week out, the crude supply comes from well to still. The steam is turned on; the gasoline comes off; while the residue passes out and into the pipe lines leading from the lease.

It's a perfect little refinery that O. Ingram has out on the Cezreaux and Martin lease at Humble. Nothing to do but hook on the pull line and fill the still; then turn on the steam and watch the gasoline come off. There is sufficient gasoline for all automobiles owned by the partnership, while Ingram has sold enough of it to pay for the one well that supplies the crude.

The well is one of the "shale" class at Humble, producing a crude of high gasoline content. It was drilled on property adjoining the Cezreaux and Martin lease. The gas proved good for fuel and the partners bought this for firing their power engine. Then the driller of the well decided to sell, so Cezreaux and Martin bought, their only purpose being to provide a fuel supply.

But Ingram knew the quality of the oil. He kept wanting gasoline from it and the refinery without a problem is the result.

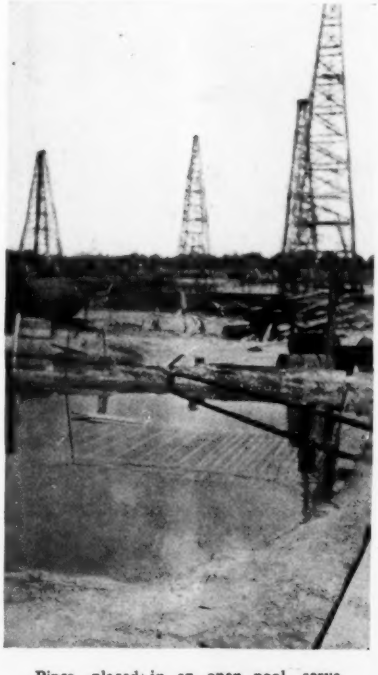
The plant is home made and hand made. The still is a discarded gas separator. It has been set upright and enclosed within wooden walls. The line from the well pump discharges into the top of the old separator.

One-inch pipe was used at the bottom for a steam coil, which was connected with the boiler in the power plant nearby. Another pipe allows the introduction of live steam in the oil while it is under heat, helping to take off the vapor.

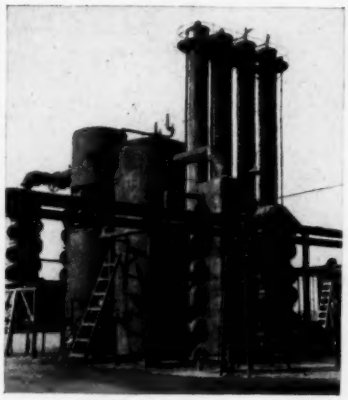
The well is pumped regularly, discharging into this improvised still, instead of a tank as other wells on the lease do. When it is full, the boiler is turned into the coil and live steam turned into the column of oil in the still.

The vapors discharge overhead and pass through a condenser, devised by Ingram. It is a system of one-inch pipe, laid within a pool of clear water. After condensing, the gasoline passes into a barrel, at the bottom of which is a bleeder to allow water to pass out, while gasoline is skimmed from the top and poured in barrels.

All automobiles operated by Cezreaux and Martin are run on this gasoline. It might be added that Ingram is not bothered by initial point, end point, color and doctor test. But he gets a good product, for it has a ready market throughout the Humble field. Sales of the gasoline have been sufficient to pay the cost of the one well, while it has provided fuel along with the oil it has made.



Pipes, placed in an open pool, serve for a condenser



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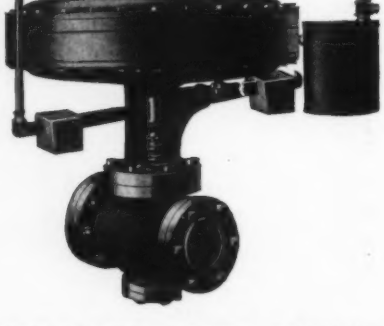

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Boiler Efficiency Essential to Refining

(Continued from page 15)

efficiency usually guaranteed in the boiler.

Circulation Important

The steaming capacity and efficiency of a boiler is affected materially by circulation; when circulation is restricted at any point, not only is capacity reduced, but efficiency is also lowered. And, when rapid circulation is secured, the steaming capacity may be limited by liberating surface. Both these are elements of boiler design.

The inclination of tubes sets up circulation of water by buoyancy and frictional contact of steam bubbles in the water; by the decrease in weight of water in the tubes and leg or front header, which unbalances the two columns A and B of Figure No. 2. The entering column B is heavier than the leaving column A, which accelerates circulation.

The liberating surface of this boiler is seen to be the exposed water surface in the drum. When this is small, the steam bubbles crowd one another and carry moisture along with them into the steam outlet. Therefore, the liberating surface should be proportionate to the steaming capacity; any limitation in this direction reduces steaming capacity just as effectively as taking out some heating surface.

A boiler arranged for test, under study by the writer, showed that liberating steam forms little water spouts on the surface of water. When the draft of steam is gradually increased, these little water spouts rise higher and higher and more moisture is entrained in the liberated steam. When a sudden draft of steam occurs, as when opening a big valve suddenly, the water spouts higher than when the valve is opened slowly. Therefore, sudden drafts of steam set up priming that might be otherwise avoided if steam is withdrawn in slowly increasing amounts to allow the circulation to increase and afford more steam.

Large charges of cold water make the boiler prime and foam, due to cooling the boiler and reducing the steam pressure and boiler temperature; lowering temperature in a boiler always sets up priming with average feed water.

Cold water charges also set up internal stresses in tubes, sheets and stays, may even crack a header sheet, and the tube ends may be loosened so much as to leak. In marine work, water colder than 100 degrees F. is prohibited by law from being pumped into steaming boilers.

The boiler feeding pumps should not be so large that they can be run only at intervals else these shots of cold water may be pumped in. Automatic feed water regulation with high and low alarms is conducive to economy, not only of fuel but also in point of maintenance of equipment.

All natural waters contain more or

less foreign matter either in solution or suspension. Boiler scale forming solids are of two general kinds; soft scale, made up of carbonates of lime and magnesia and hard scale, made up of sulphates. And the soluble salts of sodium, silica, alumina and iron, as well as suspended matter, mud, tend to form scale in the boiler and reduce its steaming capacity and efficiency.

The retarded heat transmission due to scale not only lowers economy but sets up weakness in plates and tubes due to overheating.

The refinery boiler feed water is not handled in the same manner as the feed water of a turbo-generator power station. In the power station, the turbines may run condensing and with surface condensers, the feed water is recovered as pure, distilled water, free from scale or oil or any other contamination. Therefore, surface condensers are of much more value than jet or barometric condensers for central power station work, and we find the practice almost universal to use only surface condensers for this reason.

But there are many refineries that operate tubo-generators also and, insofar as this water is concerned, this portion of the steam using equipment should by all means be equipped with surface condensers because of usual feedwater conditions. In practice, a portion of feed water is lost in its cycle through the boilers and turbines so that approximately 10 per cent must be added daily for make up, which insures that there is no content that may injure the boiler surfaces and turbine blading.

Where boiler feed water has a large scale forming content, such as might be taken from, say the Canadian River, the portion that is condensed along with oil vapors is also distilled water and, having passed through with oil, there may be in some oil, substances that the water absorbs and carries with it into the run down tanks, and prohibit the use of this water in boilers as drained from run downs. But there is no question that this water can also be purified by proper means and made usable again with safety, and the scale forming solids of this portion of feed water eliminated.

Waters containing magnesium chloride and sulphate, organic matter and acids tend to corrode the boiler; and those waters with a content of alkalies, sodium carbonate and organic matter also, set up priming.

The estimation of the quality of boiler feed water cannot be solely by the scale forming content or by the content of soluble salts; the former in very small amounts may be more injurious than the latter in larger amounts.

There is no remedy for sodium chloride in quantity in feed water; this can be removed only by distillation, leaving the solids behind. Concentration of salts within the boiler sets up priming and should the salt content

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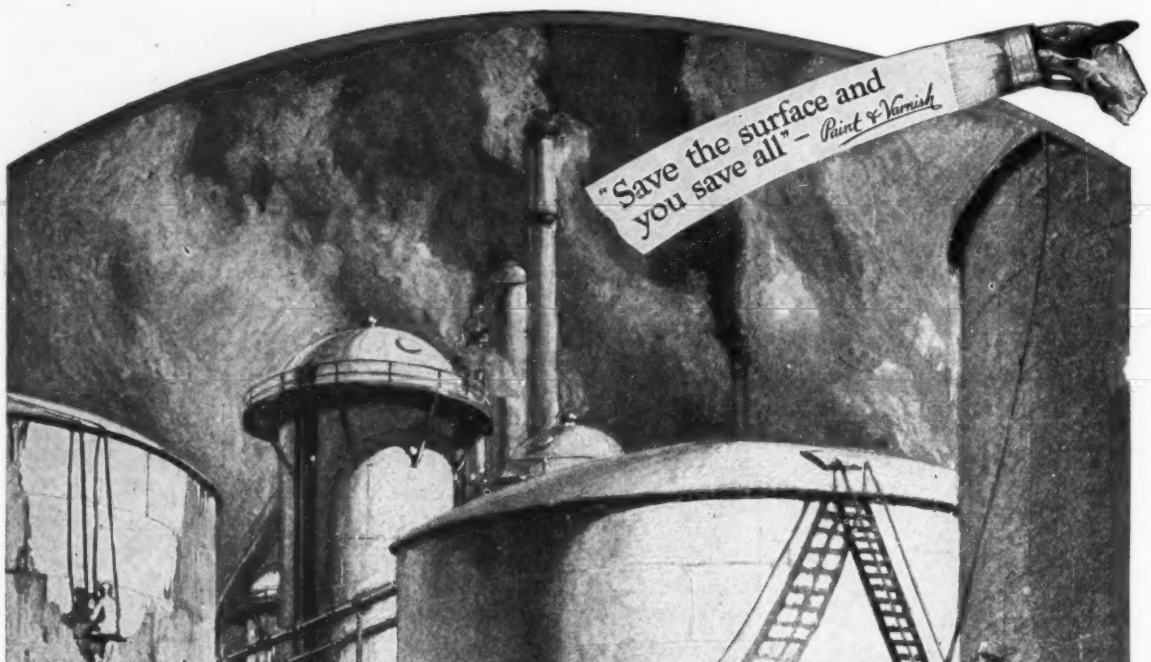

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be so high that priming results, the only remedy is a better supply of water. Boilers may deliver commercially dry steam with an appreciable amount of salt but the high steaming rates now customary cannot be obtained with bad feedwater.

Removing Scale

Boiler compounds for removing scale are almost always based upon converting the scale forming elements into new substances which will not form a hard, adhering scale and which may be readily removed by blowing off, washing or skimming. Thus, the soda compounds act by combining with the soluble scale to form insoluble solids, or to precipitate them, when they sink. Tannic acid compounds used in connection with soda act by penetrating to the boiler steel which breaks up scale by decomposition and loosening.

Compounds should be used only in clean boilers. On the basis, though, that it is better to prevent scale than to allow it to form in the boiler, and large scale formations in boilers are dangerous, water should be treated before being pumped into the boiler.

For boiler feed water treatment outside of the boiler, the water softener is always the delight of the user of water that forms scale. The writer once repaired a battery of horizontal return tubular boilers fed with water from the Canadian River. When the damaged tubes and sheets were removed, there was nothing left but the upper portion of the barrel shell. But, upon placing the battery back into service, together with a water softener, the battery has been in service since with a remarkable gain in economy, not only as to fuel but also as to maintenance. Those boilers would yield a wagon load of scale weekly, but this now comes out of the softener where it can do no harm.

Lime treatment consists of dehydrating lime, then charging the water with it, precipitating scale, and the scale is then allowed to settle before using the water.

Another method of removing scale is simply by heat. A portion of the CO_2 content is driven off by heat at temperatures from 200 to 210 F., when the carbonates of lime and magnesia are precipitated. Then, to use an open feedwater heater to raise the temperature to 210 F. is sufficient for the soft scale. To remove the hard scale, chemicals may be introduced into the water at this temperature, and the water settled.

Also, when water is raised to boiler temperature, hard scale forming solids are precipitated, resulting in the live steam purifier, which uses no chemicals, but simply heats the water up to about boiler temperature and settles out the scale before introduction into the boiler.

The subject of boiler feed water purification is one to itself, however, and because of the fact that economy and capacity depend upon feedwater also, it is worthy of the most careful consideration from specialists.

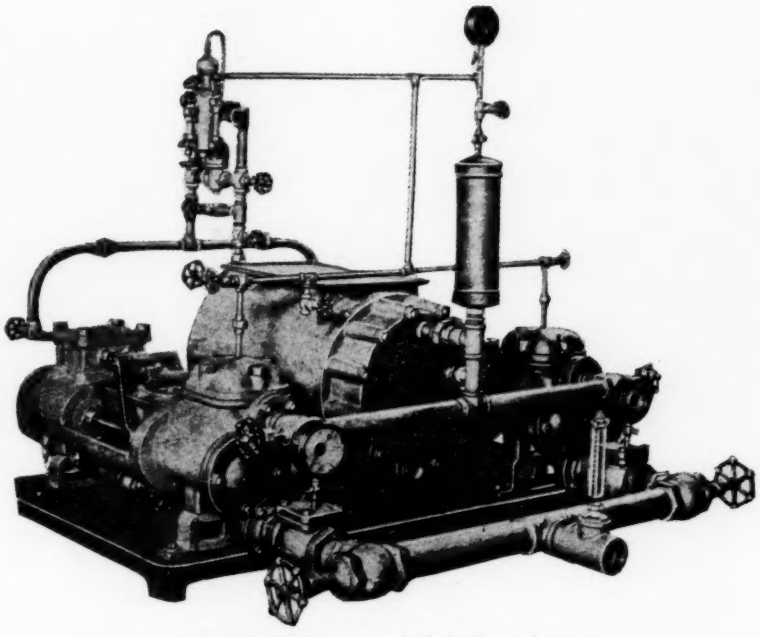


Figure 7.—Lockett automatic fuel oil pumping set

Boilers may be freed of scale by boiling a solution of soda ash within the boiler for twenty-four hours with no steam pressure, then using some kind of tube cleaner to dislodge the scale so loosened. When scale is thus removed, the tube ends may leak and require rolling but the boiler is safer and more economical when in good condition.

Removing Soot

Soot is an enemy of efficiency; if the setting is not smokeless, it should be made as nearly so as possible. The soot blower, in place, used by simply turning on steam, is a necessary adjunct to any boiler installation and daily brushing of tubular boilers is imperative.

When a boiler is taken out of service, if the fuel oil used has an appreciable sulphur content, the burnt gases contain sulphur compounds which may unite with oxygen of the air of combustion and form sulphuric acid. This collects, of course, in the soot, wets it, when the acid may reach the boiler steel and cause pitting on the exterior or fire side. The remedy is that when the boiler is to remain out of service for some time, the tubes must be brushed free of soot, then a solution of lime water or other neutralizing base brushed on to destroy the acid.

The higher the steam pressure, the greater the efficiency of any prime mover. Steam pumps are more economical with high pressure; turbines are more economical. But in refining work, there is also another advantage of high pressure in the steam used for stills, by reducing its pressure through a valve. As outlined in a previous paper in The Refiner and Natural Gasoline Manufacturer, all steam used in stills must be bone dry else moisture entering the still, mingling with the oil and flashing into steam causes belching.

When steam is reduced in pressure without taking heat from it in the form of work, such steam takes on superheat; in the presence of superheat, moisture flashes into steam, so that the steam is then perfectly dry and free of water. Since the quantity of superheat is proportional to the reduction in pressure, it follows that when steam is reduced from 150 pounds gauge to a still header pressure 20 pounds, the quantity of superheat is greater than when the pressure is reduced from 100 pounds to 20. Therefore, high pressure steam for stills also, is productive of better conditioning of steam for injection into the oil within stills and a high pressure installation is therefore worth the additional cost due to this phase.

Super Heaters Essential

Since dry steam is a necessity for distillation of oil, the one way to insure freedom from moisture is by using superheaters in the boiler setting as shown in Figures Nos. 2 and 3. When a boiler delivers wet steam, due to design of the boiler, or to bad water, or forcing, or poor operation, the superheater is effective in drying the steam, although the superheater should not be depended upon to evaporate water; it has another function. Steam from the boiler should not have more than a commercial quantity of moisture; commercially dry steam contains not over 2% to 3% of water.

Where the boiler feed water contains

foreign matter that sets up priming, as salt, the salt content in the boiler increases as water is evaporated, until the maximum permissible accumulates, when the boiler must be washed. Beginning with a freshly washed boiler, the salt content gradually increases, and therefore priming is a variable quantity, but the steam that is passed through superheaters is dry, continually, although the quantity of superheat may gradually reduce as the water content of the steam increases.

In steam driven machinery, the lower the economy the greater effect superheat has in improving such economy; steam pumps, large consumers of steam, are improved in economy. Also, steam turbines are improved in economy, but for another reason. Steam has a greater volume when superheated and the blading of turbines is not abraded by dry steam so much as by wet steam.

The improvement in economy due to superheat may be from 5% to 20%, depending upon the prime mover.

Superheated steam does not conduct heat as readily as saturated steam, therefore, there is not so much loss in the long steam lines necessary to convey steam to the various processes in the refinery and to have it available for fire fighting purposes. If the quality of superheated steam is such at the boiler that it reaches destination with still a little superheat, there has been no condensation; the loss due to reduction in temperature is small, but if condensation occurs, much more heat is lost since the reduction in temperature of steam without condensation is but a trifle of the heat loss due to condensation,—to latent heat. We can see, therefore, that superheat in a refinery has every advantage—more than in the usual steam electric central station.

The size of boiler units, boiler and battery, can be proportioned so that when one unit, boiler or battery, is cut out of service, the remaining units can be overloaded until the first unit is back in service. Thus, assuming that 750 horsepower is necessary, a division into two units of 375 horsepower each requires one to be overloaded 100% when the other is cut out. But a division into three units of 250 horsepower each means that when one is cut out, the two other two can be run at 50% overload until the one is back in service. And, with this arrangement, there is no surplus equipment.

The pressure carried on horizontal return tubular boilers ranges from 85 to 125 pounds, with 100 pounds an average. Because of the increase of shell thickness at a greater rate than boiler diameter, this type of boiler is limited in size, because of the excessive thickness of shell plates required by large diameters. In large installations, this limitation is serious.

Water Tube Boiler Safe

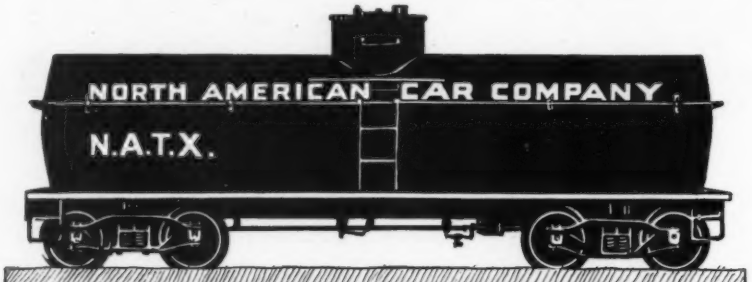
Other limitations are that scale forming solids tend to settle on to the fire sheets, causing overheating and forming of bags, making the boiler unsafe. And due to imperfect circulation, the efficiency of this boiler is not as high as that of water tube boilers. When the load is just right, and the design is just correct, the efficiency may be just as high, but the range of load is not as variable with approximate maintenance of economy, consequently the performance of shell boilers in general is not as good as the average of water tube boilers. The horizontal return tubular boiler furnace, Fig. No. 4, does not lend itself to the installation of superheaters and we find very few of these boilers so equipped.

The water tube boiler is essentially a safety boiler; there are no large sheets exposed to the hottest flame; repairs are easily made; the pressure may be maintained at rating for longer periods because the defects that appear in tubular boilers do not appear as quickly as in water tube boilers.

Under test, the writer has found that the average shell boiler ranges between 60% and 70% efficiency; and that water tube boilers, average, range from 70% to 80%, which means that the fuel consumed by the shell boiler is approximately 15% less, under the same conditions.

When discussing boiler observations, we must remember that it is just as

(Continued on page 46)



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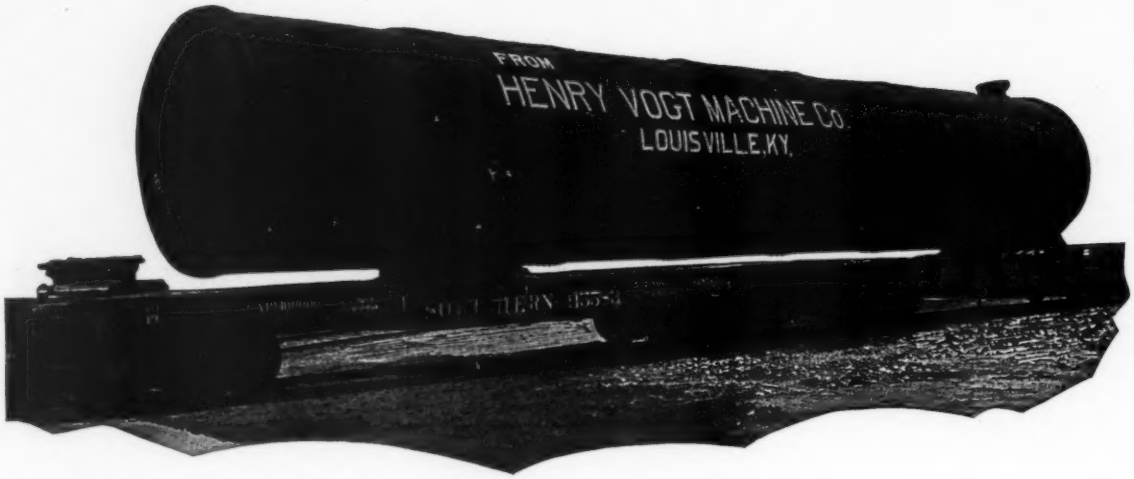

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A. P. I. Preliminary Program Announced

(Continued from page 11)

ume of Petroleum Products to a 60° F. Temperature Base.

Round Table Discussion on Lightning Protection. Preliminary statement by Ralph J. Reed, Union Oil Company of California.

Group 3—General Topic: Problems of Oil Taxation and Accounting.

"The Value of Standardization of Cost Accounting." (Speaker to be announced.)

"Problems of a General Auditor." (Speaker to be announced.)

Afternoon

2:00 p. m. Group Meetings.

Group 1—General Topic: Improvement of Oil Drilling and Production Methods and Equipment.

"Pumping Deep Wells in California," John Zublin, General Petroleum Corporation.

"Deep Drilling," H. C. Cooper, Hope Natural Gas Company.

"Cementing Deep Wells," Frank F. Hill, Union Oil Company of California.

"Dressing and Tempering Bit Steel in the Oil Fields," Francis B. Foley, Consulting Engineer, U. S. Bureau of Mines.

Group 2—General Topic: Heating the Home with Oil.

"The Place of Furnace Oil in the Petroleum Industry," O. P. Keeney, President, National Petroleum Association.

"The Problem of the Oil Burner Manufacturer," Edward P. Bailey, National Airoil Burner Company.

"Why the Domestic Oil Burner is a Household Fixture," Wallace Capen, Home Appliance Corporation.

"Comparative Values of Fuel for Domestic Heating." (Speaker to be announced.)

"Comparative Values of Fuel for Domestic Heating." (Speaker to be announced.)

Group 3—General Topic: Problems of Oil Taxation and Accounting.

Round Table Discussion of following subjects:

"Cost Accounting in Oil Refining and Sales."

"Cost Accounting in Oil Production."

"Cost Accounting in Cooperage and Other Minor Activities."

"Cost Accounting—Transportation of Oil."

"Problems in Materials Transferred from Warehouses and Fields."

"Depletion—Depreciation and Reserves."

Group 4—General Topic: Transportation of Oil by Railroads.

Open Meeting General Committee on Railroad Transportation.

General Discussion Railroad Transportation Problems.

Evening

8:00 p. m. General Session.

"The Geologist and the Petroleum Industry," E. De Golyer, Amerada Petroleum Corporation.

"California," D. M. Folsom, General Petroleum Corporation.

"The Gasoline Demand of the Future," H. L. Horning, Waukesha Motor Company.

Thursday, December 11, 1924
Morning

Important Note—The morning of this day will be devoted to group sessions, at which various subjects given below will first be treated in a prepared address by a selected speaker. After each speech, the meeting will be thrown open for general discussion and consideration of the subject.

10:00 a. m. Group Meetings.

Group 1—General Topic: Problems of Oil Taxation and Accounting.

"Valuations of Oil Properties for All Purposes," J. L. Darnell.

"Income Tax Problems in the Oil Industry," J. J. Cosgrove.

"Invested Capital—Realized Appreciation," F. R. Angevine.

Group 2—General Topic: Standardization of Oil Field Equipment.

"Standardization of Rotary Drilling Equipment." Committee Report: J. F. Lucey, National Chairman.

"Standardization of Rig Irons." Committee Report: H. J. Lockhart, National chairman.

"Standardization of Standard Rigs and Derricks." Committee Report: W. W. Fondren, National Chairman.

"Standardization of Wire Rope and Manila Cordage." Committee Report: C. C. Scharpenburg, National Chairman.

Group 3—General Topic: Motor Fuel and Motor Lubrication.

"Report on Motor Fuel Investigation," H. K. Griffin, U. S. Bureau of Standards.

"A New Method for the Determination of Crank Case Dilution," H. K. Griffin, U. S. Bureau of Standards.

"Lubrication of the Automobile Engine." (Speaker to be announced.)

"Utilization of Motor Fuel From the Standpoint of the Automotive Engineer." (Speaker to be announced.)

12:00 Noon Meeting Board of Directors (Luncheon): Election of Officers, etc.

Afternoon

2:30 p. m. General Session.

(The program and speakers for this general session will be announced later.)

Evening

5:30 p. m. Barbecue Dinner.

8:30 p. m. Rodeo.

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RECENT REFINERY PATENTS ISSUED

BY STAFF REPRESENTATIVE

Washington, D. C.—The following patents of interest to the refining industry were granted by the United States Patent Office during the month of October:

No. 1,510,918, issued October 7 to Robert J. Black, Kansas City, Kans., for a process of making gasoline and the like, consisting in heating a body of heavier hydrocarbons at a cracking temperature under pressure in an externally heated shell still, and continuously injecting highly compressed still gases, enriched with gases containing a large amount of available hydrogen, against the most highly heated surface of the still shell with which the liquid is in contact, that is into the region of most active decomposition, and over substantially all of the heated area therof.

No. 1,510,983, issued October 7 to Samuel H. Dolbear, San Francisco, assignor of one-half to Edwin Letts Oliver, San Francisco, for a method of recovering oil from shale which consists of converting such shale into a liquid pulp, subjecting the pulp to froth flotation, separating the resultant froth from the remainder and destructively distilling only those particles taken off with the froth.

No. 1,511,854, issued October 14 to Millard F. Waters, Tulsa, Okla., assignor to Smith Separator Company, Tulsa, for a combined flow tank, separator and scrubber, consisting of an arrangement of baffles in a container, including a conical perforated baffle secured to the inner wall of said container, a solid conical baffle secured to and above said perforated baffle and spaced apart from the wall of said container, and means for conveying any heavy products which may rise to the top of said container, back to the bottom thereof.

No. 1,512,263, issued October 21 to Otto P. Amend, New York, for a process of converting oils having boiling points about 150 degrees C. into a low-boiling hydrocarbon distillate, which consists in maintaining in engagement with a relatively stationary body of the liquid hydrocarbon to be converted a non-metallic resistance conductor, causing a low voltage, high amperage electric current to pass through such conductor to maintain it at an incandescent temperature of between a cherry red and a white heat, introducing a fixed gas, and subjecting the liquid hydrocarbon to a controlled pressure of its evolved vapors in excess of two atmospheres and below thirty atmospheres, and collecting and condensing the resulting cracked vapors.

No. 1,512,264, issued October 21 to Otta P. Amend, New York, for a process of converting kerosene into a low boiling hydrocarbon distillate consisting in subjecting the kerosene first in the liquid and then in the vapor state to contact with carbon heated electrically to a temperature ranging from a bright red to a white heat under a regulated pressure in excess of atmospheric and below five hundred pounds to the square inch, and maintaining such pressure upon the hydrocarbons both during their conversion and throughout the course of their cooling and condensation.

No. 1,512,358, issued October 21 to Bertram Neill, Norwalk, Calif., for an apparatus for separating liquids from gas, consisting of the combination of a shell having an inlet port for well product to be treated, outlet means for oil, separate outlet means for heavier constituents such as sand and water in the product, an outlet for the gas in the product, and independent self-opening valves exterior of the shell for controlling the oil outlet and the gas outlet, and means in the shell for automatically closing the valves.

HILLS-McCANNA NO. 45

A BRONZE WITH THE STRENGTH OF STEEL

The attitude of taking corrosion and its resulting expensive replacements for granted has no doubt been due to your belief that a really non-corrosive metal could not be procured

No 45 Alloy is doing much to dispel this belief

In condenser box service where severe corrosion occurs as the gases strike the water level and change into liquid nipples made of No 45 show no corrosive action after months of service

Let No 45 demonstrate its worth to you in actual service We offer a complete service from the casting to the finished product ready for installation

Anything that can be cast or forged can be made in No 45 Alloy

Our Forty Series Alloys of which No 45 is one cover a wide range of high tensile bronzes

A Fifty Series of high nickel alloys has also been developed to round out our line and to enable us to offer to the trade any of the acid resisting metals that best meet their existing requirements

HILLS-McCANNA CO.
2025 Elston Ave Chicago

Tell them where you saw the ad

Cutaway view shows rugged strength of cast-iron Sterling Section and oval form of broad, free passages.

Sterling Cast-Iron Sections *run clean*

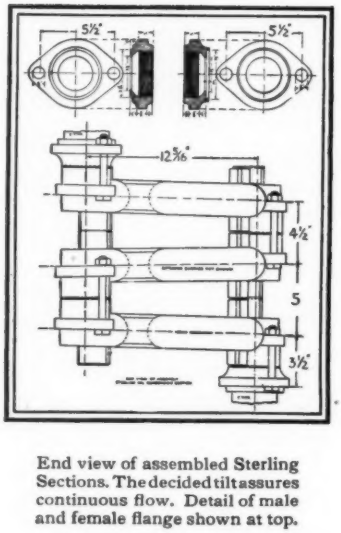
STERLING SECTIONS cool oils more efficiently and economically than any old-style device. The heavy fins quickly dissipate the heat.

They cost less to buy, less to install; last three to four times as long; use only about half the space. Cast-iron effectively resists the destructive action of water on the outside and of oil vapors or acids within.

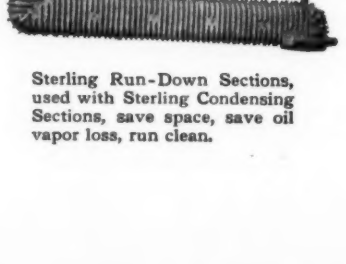
Combinations innumerable may be made of Sterling Condenser and Sterling Run-Down Sections. They are operating successfully on topping stills, re-run stills, lube stills, wax distillate stills, and on all stills in continuous batteries. The broad, free passages insure continuous flow and, when the run is changed, condensers may be cleaned out with utmost ease.

Not only is there a great saving in box room required but, should production requirements decrease, *Sterling Sections give 100% salvage;* they are as easily dissembled as assembled.

12″ and 24″ cast-iron Pipe Companion Flanges are now available; you can now have cast-iron durability throughout.



End view of assembled Sterling Sections. The decided tilt assures continuous flow. Detail of male and female flange shown at top.



Sterling Run-Down Sections, used with Sterling Condensing Sections, save space, save oil vapor loss, run clean.

STERLING OIL CONDENSING SECTIONS

AMERICAN RADIATOR COMPANY

Industrial Sales Offices: 1807 Elmwood Ave., Buffalo, N.Y.

Sterling Condensing Sections are immediately available at our plants in
KANSAS CITY, MO. SPRINGFIELD, OHIO BUFFALO, N.Y.

Texas Natural Gasoline Plants Running Ahead 1923 Monthly Average Output

Fort Worth, Texas.—Natural gasoline shipments from North and Central West Texas are maintaining a higher average per month during the last half of 1924 than was reported during the first six months of the year, and their total natural gasoline production this year will greatly exceed the high record established in 1923. The introduction of new plants and more efficient equipment in old plants in some of the fields has contributed to a steady increase in gasoline production, despite the fact that the volume of gas in many of the fields is on the decline.

Shipments of natural gasoline made from North and Central West Texas fields during the first six months of 1924 reached 105,088,536 gallons, a monthly average of 17,514,756 gallons, while the totals for July, August and September amounted to 56,644,812 gallons, or an average of 18,881,604 gallons per month. Both July and August were record-breaking months on shipments, and the latter month established a new peak for the state when 19,754,700 gallons of natural gasoline were marketed by the 128 plants. The nearest approach to the record shipments made in August occurred on the month previous when 19,023,312 gallons were moved from storage tanks. July and August are the only two months that shipments have ever exceeded the 19,000,000 gallon mark. These record figures were largely due to natural gasoline stocks having been carried over from May and June owing to market conditions and low prices, while actual production has hardly reached the nineteen million gallon level.

Natural gasoline shipments made during the year 1923 amounted to 185,845,548 gallons, or a monthly average of 15,487,129 gallons, while the monthly average for the first nine months in 1924 is reported at 17,970,372 gallons, thereby indicating a noticeable gain for the present year.

New Fields Opened

The Big Lake oil field, West Texas, and the South Vernon field, North Texas, are heralded as the next fields for expansion of the natural gasoline industry in Texas, and both offer great possibilities with a comparatively high natural gasoline yield. The Big Lake field is at present controlled by the Big Lake Oil Company and the Texon Oil & Land Company, and can not be invaded by outside companies until the field is extended beyond the holdings of these two concerns. Other fields, however, are promised from this general section of the state.

The Big Lake Oil Company has begun construction on the first gasoline plant for the field, and has set six compressors and completed all concrete foundation work. This plant will handle in excess of 5,000,000 cubic feet of gas daily. It will be enlarged as the gas production of the field increases.

The South Vernon field gives promise of being somewhat like the Electra district, as it is producing considerable gas with oil testing 41 gravity and above. It is reported that new gas in the South Vernon deep sand tests about two and one-half gallons per 1000 cubic feet. Natural gasoline manufacturers are now in the field soliciting gas contracts, while one large manufacturer in the Monroe, Louisiana, field has already tied up gas production on a large number of leases in the productive area, with prospects of a plant being started before the first of the year.

The promise of an early advance in crude prices has served to encourage new drilling in the Central West Texas fields, and plant owners in Stephens, Eastland and Young counties are looking forward to considerable new gas being uncovered before next summer. The condition of the crude market during the past six months has checked the volume of new gas and oil production in these three counties by reason of drilling costs and poor demand for crude even at low prices, with the result that only a few new plants have been built during the past year.

New Plant Operating

The Newton absorption process of extracting gasoline from gas is being introduced into Texas for the first time, and a plant is now nearing completion on the H. R. Gandy lease, located southwest of Breckenridge in Stephens county. The Hur-Bar Gasoline Company of Tulsa is installing this plant. When completed it will have a daily capacity of about 10,000,000 cubic feet of gas, with an expected yield of one-half gallon per thousand cubic feet of gas. The gas contracted for this plant is leaner than the average gas produced in Stephens county, so the operation of the plant will be watched with interest as considerable gas of this kind is available in Central West Texas fields, but has been passed up because of inadequate equipment to handle it at a profit. The Hur-Bar Gasoline Company was organized last summer with a capital stock of $100,000, and has the following officers: Morrison Barclay, president; A. E. Hurley, vice-president; and C. E. Hurley, secretary-treasurer. E. C. Hughes is superintendent in charge of the plant.

The Landreth Gasoline Company of Breckenridge, Texas, is reported to be contemplating further increases to its natural gasoline plant in the Ibex field, after having completed four separate additions since the plant was officially completed in September, 1923. Of the four additions made to the plant, three included low pressure units, and the other was a complete charcoal process to operate on residue gas from the high pressure units. It is reported that a second charcoal process unit may be erected shortly to operate on the residue from the low pressure side of the plant. This plant is the only one in the Ibex field, which is building up a reputation for long lived gas production from wells producing high gravity oil from the deep lime pay, and will probably have a daily production of about 47,000 gallons of gasoline when contemplated additions are completed.

Shipments of natural gasoline from the various manufacturing centers in Texas during July, August and September follows:

Fields—	July	August	September
Stephens County	129,925	154,935	115,945
Ranger-Eastland-Pioneer	122,490	113,605	114,745
Desdemona-Gorman	70,635	75,070	84,350
Burkburnett	56,453	52,565	52,295
Shackelford County	35,115	32,860	22,490
Electra	18,050	16,565	17,125
Young County	13,358	17,665	11,715
Petrolia-Clay County	4,805	4,795	4,800
Brown County	1,545	1,700	1,345
Amarillo-Potter County	560	590	590
Totals in bbls. (42 gals.)	452,936	470,350	425,400

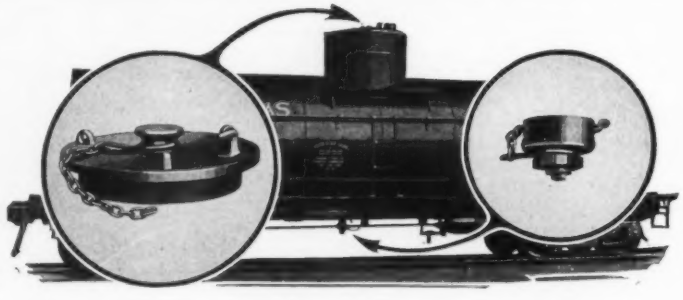
Plant Under Construction

Panhandle, Texas. — Construction work is under way on the erection of the Big Four Refining Company of Texas' 2,000-barrel daily capacity skimming plant near here, and it will operate on crude transported by the Plains Pipe Line Company's line from the Carson-Hutchinson county oil field in the Panhandle district. This plant was formerly operated under the name of the Pauline Refining Company at Duncan, Oklahoma, and when completed will manufacture gasoline, gas oils, and fuel oil. J. D. Wrather of Long Beach, Calif., is president of the Big Four Company, and is also at the head of the Big Four Refining Company of Long Beach, California.

Two Carbon Black Plants Being Built at Pioneer

Ranger, Texas.—Two separate types of carbon black manufacturing plants are being erected in the Pioneer field, Eastland County, to operate on residue gas from natural gasoline plants operated by the Phillips Petroleum Company. The Western Carbon Company is erecting a standard type of carbon black plant to burn 12,000,000 cubic feet of gas daily. When completed it will have three units of 30 burning houses each. Mr. Flint is in charge of the construction of the plant.

The second plant for the Pioneer field is being erected by the Peerless Carbon Black Company, and will make use of the Peerless type of plant, which turns out a superior grade of black, used for the manufacture of indelible inks and high grade printers' ink. This plant will be only one unit. O. Johnson will have charge of the operation of the plant.



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A manufacturer's good name is of more value to him than the immediate profits of one sale. The far-sighted business man puts something that is not for sale into every product he makes—his good name and reputation for fair dealing.

When you deal with us, you get with your purchase that extra quality and assurance which can be obtained only from a manufacturer of unquestioned character.

It will pay you well to consider every angle of your problem when buying stock specialties such as ours—dome covers and outlet caps. Buy for permanence, reliability and satisfactory service.

Orders by Wire or Letter Promptly Handled

Specialists in:

Brake Shoes, Gray Iron Castings, Plate Work, Beams, Sheet and Structural Steel

Oil Well Rig Irons and Refinery Equipment.

Western Iron and Foundry Co.

Wichita, Kansas

Composition Roofing Has Many Special Features

Economy of structure and of application without sacrifice of strength is one of the big claims made for "Asbestone," a roofing material manufactured by the R. J. Dorn Company, Inc., New Orleans, Louisiana.

This material owes its strength to the reinforcement, under enormous hydraulic pressure, of Portland cement with asbestos fibre. The fibre possesses a tensile strength as high as 25 tons per square inch, and the fibre is distributed through the cement with absolute uniformity, both in the surface and section of the sheets. While still in a plastic state, the sheets are subjected to a pressure of over 50,000 pounds per square inch of section, finally cured with steam.

"Asbestone" can be used on any roof with a pitch of at least 2 inches to the foot, and for any sidings. Special curved sheets can be furnished for curved roofs at an additional cost.

Manufacturers of the product state that a shower of burning embers on a roof or wall of "Asbestone" is as harmless as a rainfall. The material is non-inflammable. It withstands very high temperatures and therefore localizes and restricts fires, whether internal or external.

No reinforcement or sheathing of any kind is required. "Asbestone" is applied directly on and fastened to purlins and girths, and is made in convenient lengths to fit a wide range of purlin and girth spacings.

Further information will be furnished by R. J. Dorn Company, Inc., 82 Wall Street, New York City, New York.

Plant for Colorado

A party of Colorado and Texas interests contemplate the construction of a refinery in the Wellington-Fort Collins district in Larimer County, Colorado, with a charging capacity of upwards of 3000 barrels and with an estimated cost of approximately $700,000. The company would be known as the Fort Collins Refining Company.

P. & R. Building Plant

Producers and Refiners Corporation is constructing a 10,000,000 cubic foot absorption plant at the Parco refinery at Rawlins, Wyoming. It will handle gas produced at Eight Mile Lake and now being shipped to Parco for fuel. After the gasoline has been extracted the residue will be turned back in the lines for use under refinery stills.

New Grades of Natural Gasoline

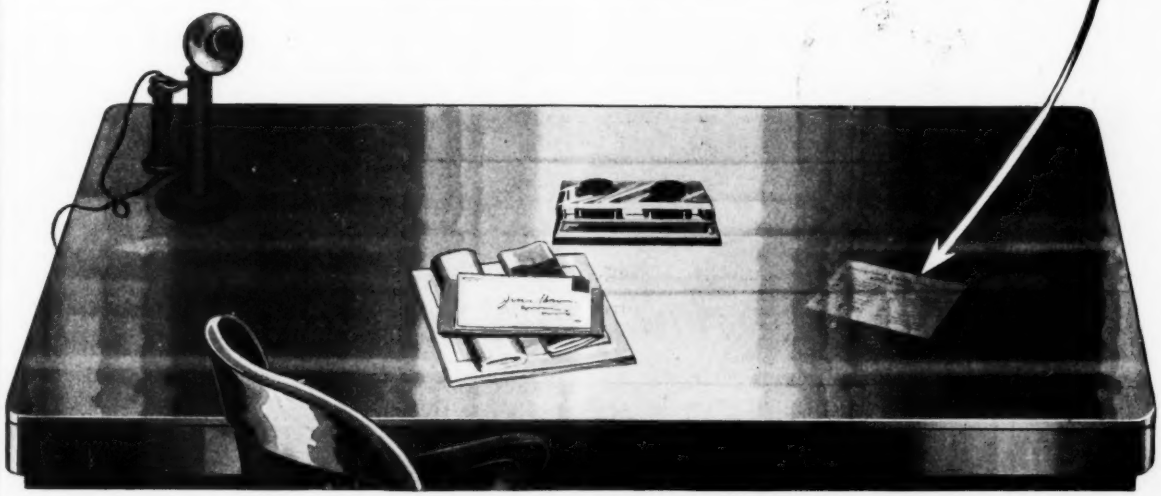
Cut this out and put it under the glass of your desk or some other convenient place.

OFFICIAL SPECIFICATIONS
for Natural Gasoline as adopted and issued by the Association of Natural Gasoline Manufacturers; Revised October 1, 1924.

All Grades are Manufactured by Chestnut & Smith Corporation

GRADE "DOUBLE A"	GRADE "DOUBLE B"
Recovery....Not less than 90%	Recovery....Not less than 85%
End Point...Not over 375° F.	End Point...Not over 375° F.
Gravity.....80.0 to 87.9° Be.	Gravity.....84.0 to 92.0° Be.

GRADE "A"	GRADE "C"	GRADE "B"
Recovery....Not less than 90%	Recovery....Not less than 78%	Recovery....Not less than 85%
End Point...Not over 375° F.	End Point...Not over 375° F.	End Point...Not over 375° F.
Gravity.....72.0 to 79.9° Be.	Gravity.....80.0 to 90.0 Be.	Gravity.....76.0 to 83.9° Be.



CHESTNUT & SMITH CORPORATION

GENERAL OFFICES—CHESTNUT & SMITH BLDG.— TULSA, OKLA.

Boiler Efficiency Essential to Refining

(Continued from page 36)

logical to hand over large amounts of cash to an employe for disbursement without accounting, as it is to hand over large amounts of cash fuel to the fireman without an accounting. Every business keeps account of its cash, but the percentage that keeps account of the use of its cash fuel is small; the fireman uses it without any kind of accounting.

Keeping Account

In keeping tab upon boiler performances, the equipment is not elaborate, unless the owner so desires. The instruments necessary are now so made that the fireman can generate steam and maintain economy by observing the CO_2 analyzer and the draft gauge, better than he can by watching the steam gauge.

First, the water and oil must be measured, to ascertain the proportion of water evaporated to oil consumed;

Then, draft gauges, pyrometer, thermometers and pressure gauges;

And flue gas analyzing apparatus.

These may be as simple or as elaborate as desired, but because boiler performance should be observed continuously, instruments of the recording type are of more value. And, when the values are obtained, it is not such a difficult matter to compute the efficiency obtained.

When water is converted into steam, heat must be added to raise the water from its normal temperature to that equal to the temperature of steam in the boiler. This heat is the sensible heat, or the heat of the liquid. The next step is to change the water into steam at boiler pressure. There is no change of temperature at this point, but the heat required is large, and is termed latent heat or the heat of vaporization.

At 150 pounds gauge, or 165 pounds absolute pressure, assuming the water to be 32 degrees F. initially, the total heat in steam is 1193 B. t. u's as determined by many tests, and for steam at 150 pounds gauge pressure, this figure may be used, with correction for initial water temperature. And, then, with the quantity of fuel consumed, the matter of boiler efficiency is obtained.

Furance efficiency may be obtained by the flue gas analyzing apparatus of the Orsat or other type, and the composition and temperature of flue gasses is a sure indication of the economy.

The combustion of fuel oil is a chemical reaction; each pound of carbon and each pound of hydrogen of the oil, requires a definite amount of oxygen for perfect combustion, and to provide enough, the air passing through the furance exceeds the amount that combines with the vapors of oil fuel. But too large an air supply is just as detrimental as not enough because the inert nitrogen of the air must also be heated and some of the heat so imparted passes out of the stack with nitrogen.

The products of combustion are CO_2 or carbon dioxide, which is the result of perfect combustion; CO, or carbon monoxide, the result of imperfect combustion, and H_2O or water, and if sulphur is in the oil, SO_2 or sulphur dioxide. Water is first formed and then begins to dissociate into hydrogen and oxygen; it seems to require as much heat for dissociation as the products of dissociation generate upon combustion so that the water is neither beneficial nor deleterious. And the same applies to the steam used for atomization.

Proper Air Draft

The proper amount of air draft, is that which produces the greatest percentage of CO_2 without CO. There is no exception to this rule and the draft therefore should be controlled with the direction of the flue gas analyzer. When more air than is necessary is admitted, the percentage of CO_2 lowers and with it, the efficiency. Any incorrect furance or draft condition decreases the percentage of CO_2, increasing CO and C.

There are several furnace designs that pass the air through tubes heated underneath the furnace floor. Thes

PRATT & CADY VALVES

This straightway swing check valve can be used in horizontal or vertical lines. Its rotating disc distributes wear and so prolongs the service. When worn the disc can be reached to regrind by screwing out the angle plug.

READING STEEL CASTING COMPANY, Inc.

Pratt and Cady Division
929 Connecticut Avenue
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Stocked by
NORVELL-WILDER Hardware Co., Beaumont, Houston, Mildred and Shreveport

GRINNELL CO., OF THE PACIFIC, Los Angeles, California

P&C CO.

Announcing Development of
BROWN BUBBLE BAFFLE TOWER
For Absorption, Fractionation, Distillation

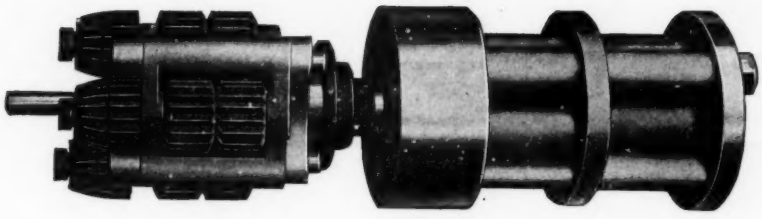
The Brown Bubble Baffle Tower has large vapor areas and a spirally directed liquid flow. Can be installed in existing tower shells without removing heads. Can be readily inspected and cleaned internally without disturbing shell or insulation. And it's cost is lower than any existing type of Bubble Tower constructed.

Full information will be given upon request, without obligation.

United Iron Works, Inc.
TULSA KANSAS CITY DALLAS

"UNITED" IRON WORKS INC. FOR SERVICE

Roto Tube Cleaners



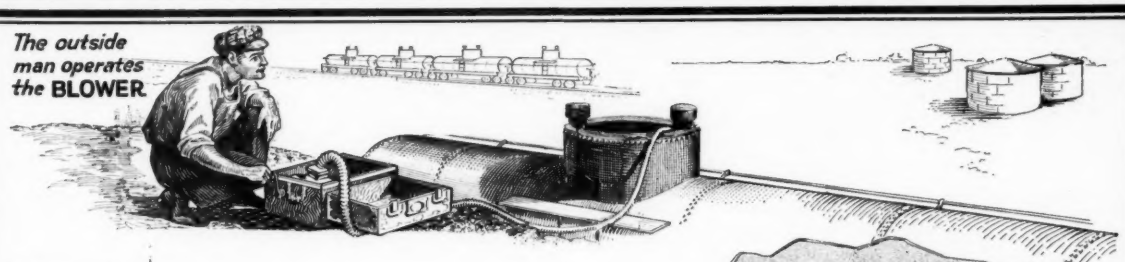
For Cleaning Cracking Still Tubes

Thorough

Fast *Safe*

The Roto Company

HARTFORD, CONN.



Feed him

FRESH-COOL-AIR

—and he'll work with greater ease, comfort and safety.

The M-S-A Standard

HOSE MASK

Supplies a continuous stream of fresh air to workers in Tank Cars, Oil Tanks, or in any confined gaseous space.

Send for Bulletin No. 99F for complete information on this and other types of Hose Masks

Mine Safety Appliances Co.

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Standard for the American Gas Association

Tell them where you saw the ad

The
Advantages of
Thermit Welding
for
Pipe Lines
and Coils

No. 5

On long lines or coils, the fact that it is not necessary to rotate the pipe while the weld is being made is only one of the advantages of Thermit Welding. The labor costs are reduced to a minimum.

Send for
Pamphlet No. 1628
which describes the many other advantages.

METAL & THERMIT CORPORATION

General Offices
120 Broadway
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FOR SALE

Three insulated tank cars in first class condition and newly painted.

Also five 6500 gallon tank cars in good condition and newly painted.

Lone Star Tank Car Company

P. O. Box 1445
Telephone 2157
Wichita Falls, Texas

designs are intended to increase the furnace temperature and maintain it above the ignition temperature without air cooling. This furnace air supply is logical.

When firing oil, ther is no fuel bed through which air must be forced. The oil blast itself induces more draft, consequently chimneys for oil fired boilers can be lower than required for coal fired boilers to afford the same amount of air. Firing rates may be required high at times, though, and the chimney should have ample surplus capacity over normal load, with damper control.

Tube Boiler Types

The types of water tube boilers are the inclined tube, longitudinal horizontal drum Fig. No. 1; the same with inclined drum, Fig. No. 5; inclined tubes with cross drums, Fig. No. 6; and bent tubes with cross drums, Fig. No. 3. While the cost of heating surface itself —tubes—is no greater in one boiler than another, the boiler with the greater amount of liberating surface compared to heating surface, is the best steamer, of course, circulation being equally as good in both, and more especially so with poor feed water.

These types of boilers are shown in the accompanying line drawings, with and without superheaters.

In the selection of boilers, the quality of water has much influence in the operation; therefore, where the water is good, the boiler that is cheaper, due to construction with less liberating surface may steam as well as another; but when the quality of water is indifferent, or bad, the boiler with the maximum of liberating surface, and with no restrictions to a fast, free circulation steams with better economy and may be loaded more heavily.

Where hard scale collects, it will be found that straight tubes are somewhat more easily cleaned than bent tubes.

The burner must atomize the oil finely so that a perfect mixture with air will be obtained, and the percentage of steam used for atomization must be low.

Practically all oil assumes the same viscosity when heated to 200 degrees F. or thereabout, therefore, heavy fuel oil can be as readily fired as light fuel oil, although the heavy fuel oil is somewhat more difficult to handle before being heated.

Then, every station should have a fuel oil heater of some kind to reduce the oil in viscosity. The types of burners are many; some take oil at low pressure at the burner tip while others require pressure to force oil from the tip. Pressure assists in atomization and the latter type is productive of better results, usually.

In general the patented burners, but not all of them, and the especially designed oil burning sets, Figure No. 7, consisting of pumps with pressure regulators, burners that atomize perfectly and use little steam in so doing, and oil heaters are more efficient and reliable than the outfit usually assembled from various sources.

But the burner is not by any means all that is necessary to high economy.

When two or more boilers are connected to a steam main, two-stop valves are required between boiler and main. One of these can preferably be an automatic stop valve. The single acting non-return stop valve closes automatically when steam begins to flow from the main back into the boiler. The double-acting automatic stop valve closes automatically either when there is an abnormal flow of steam from the boiler, or when steam flows back from main to boiler.

The single-acting stop valve cuts a boiler off of the line when the boiler gets too cold to generate steam, and begins to receive and condense steam. A cold boiler, floating on the line uses fuel to keep the furnace hot.

The double-acting valve, in addition, closes against the steam main in event of rupture of any part of the boiler; closes if the steam main ruptures, and some designs must be opened by hand.

When a fire is banked, the automatic stop valve cuts out the boiler at the proper time. Not only are these valves safer, but better economy is secured with them.

In the hands of a trained engineer the boiler is a profitable thing; the instruments necessary for boiler testing and observance of observation become a picket line that can protect the fuel bill from any assault.

Plant Operating

Brownwood, Texas.—Blue Ribbon Refineries, Inc., has resumed operation on its small refining plant here, and is making special grades of lubes from Coastal crudes shipped in via tank cars.

Electrically Driven Centrifuges
Hand Centrifuges
WRITE
WILLIAMS, BROWN & EARLE, Inc.
Manufacturers of Laboratory Apparatus
918 Chestnut St. Philadelphia, Pa.

CARBON BLACK

Channels, Angles, Roofing, Burner Pipes, etc. We are specialists in Carbon Black Building Material. Most of the buildings in Monroe, La., gas field and Stephens County, Texas, came from us.

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New Orleans, La.

SULPHURIC ACID
CHEMICALS
CARLOTS - CONTRACTS - LESS CARLOTS
Stocks—Tulsa, Houston, Dallas, San Antonio and Wichita Falls.
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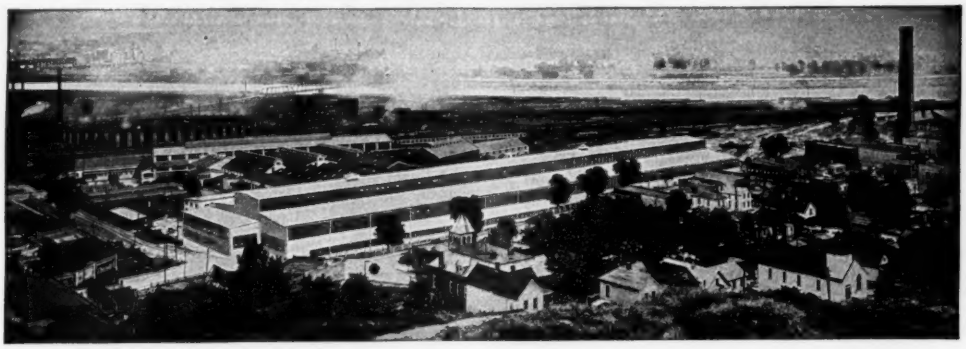
"WRITE FOR OUR CATALOG"



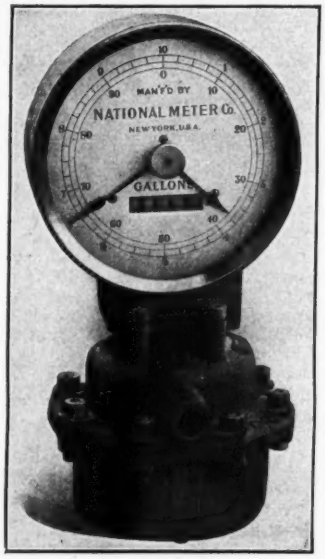
The Largest and Most Modern Steel Plant in the West—

This modern, up-to-date plant, backed by a warehouse stock of 10,000 tons and a fabricating capacity of 5,000 tons per month assures prompt delivery to all southwestern points.

KANSAS CITY STRUCTURAL STEEL CO.

KANSAS CITY, U. S. A.

Tulsa, Okla. Dallas, Texas Denver, Colo.



METERS

for accurate measurement of

Crude Oil, Fuel Oil, Gas Oil, Gasoline and other liquid products of petroleum.

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POSITIVE DISPLACEMENT
OSCILLATING PISTON TYPE

An oil meter that stands up under hard service, and that **holds** its accuracy.

Made in all sizes, 5/8" to 6" inclusive
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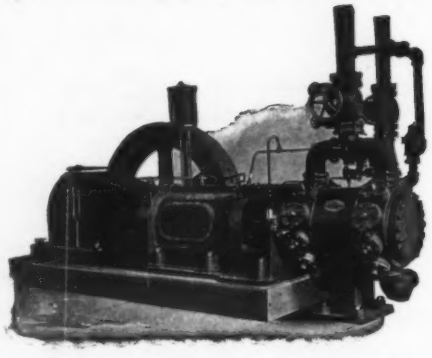

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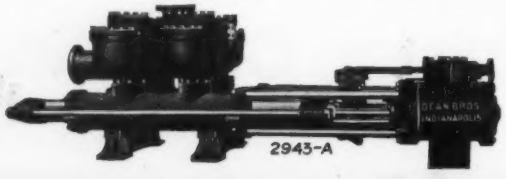

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Animal Oils—

English Degras	lb.	.04⅝
Domestic Degras bbls. carloads	lb.	.04¼
Horse	lb.	.09½

Oleic Acids—

Dist.	lb.	.11
Saponified	lb.	.11

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Prime Winter Strained

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Extra Winter Strained

2 to 4½ ffa. 40/45c. t.	lb.	.19¼
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Extra No. 1 7 to 10 ffa. 40/50c. t.	lb.	.13¼
Extra No. 1 15 to 18 ffa. 40/50c. t.	lb.	.12¾
No. 2 22 to 23 ffa. 40/45c. t.	lb.	.12¼
Prime Edible Tallow under 1⅞ ffa. 40/45c. t. N. Y.	lb.	—.11
Tallow acidless	lb.	—.12¾
Lard Stearine	lb.	—.19
Oleo Stearine	lb.	—.13½

Neatsfoot Oil—

Pure	bbls.-lb.	—.15¾
Extra	bbls.-lb.	—.13¼
No. 1	bbls.-lb.	—.12¾
Cold Pressed	lb.	—.18½

Fish Oils—

Menhaden Oil

Light pressed	gal.	.70–.72
White	gal.	.73–.76
Yellow bleached	gal.	.72–.74
*Herring, tankcars coast	gal.	–.40
Whale, ext. winter bleached	gal.	–.80
Seal		Nominal

Naval Stores—

Turpentine, N. Y.	gal.	.86
†Turpentine	gal.	.81¼
Rosin B., N. Y.	bbl.	7.50
Rosin F., N. Y.	bbl.	7.50
Rosin B.†	bbl.	6.40
Rosin F.†	bbl.	6.40
Rosin Oil 1st run	gal.	.45
Rosin Oil 2d run	gal.	.47

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Kiln Burnt	bbl.	12.50
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*Nominal.
†Savannah, Ga., market.

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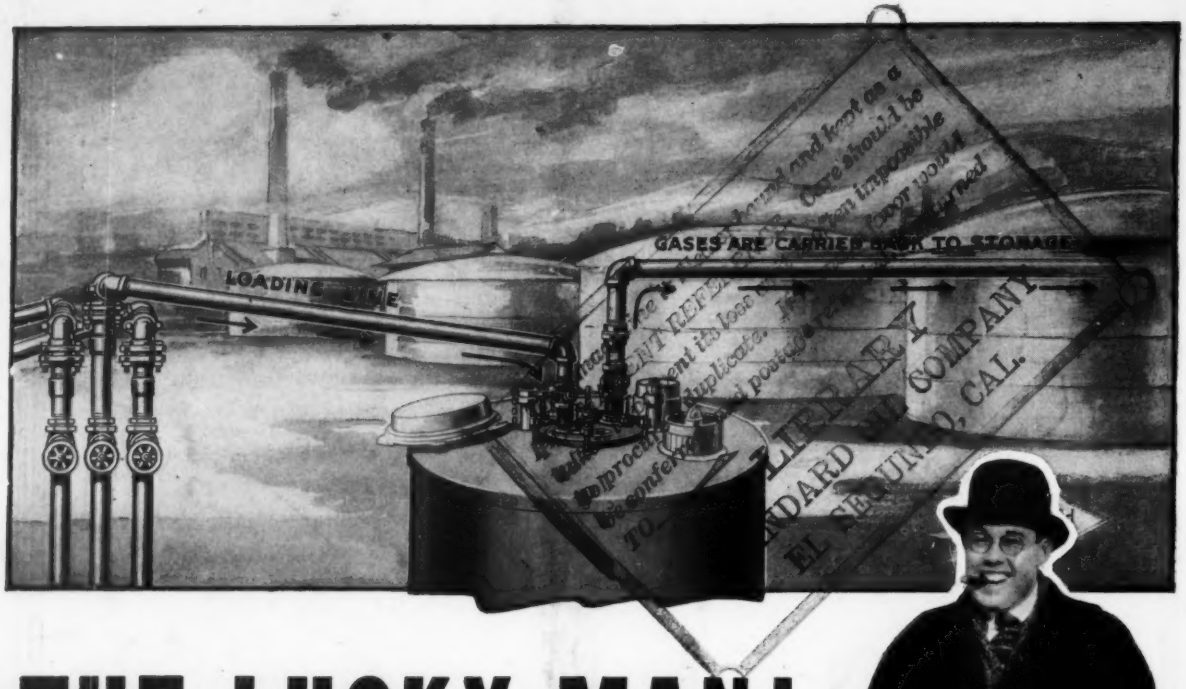

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